How to Work with Tools and Wood

For the Home Workshop

R. T. RANDOL.

"Just wait 'til you see her in the water."

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The Stanley Rule & Level Plant
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Foreword

I, too, used to think that working with tools and wood was only for the naturally skillful.

But it isn't.

With a fair knowledge of how to use tools any one can do home repair jobs and actually make simple or even elaborate things.

This book has been written to give any one that knowledge.

It may lead them into intensely interesting and profitable hours in the home workshop.

THE AUTHOR.

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CHAPTER I

All of Us Can Use Tools

Never in my boyhood life was I permitted to touch clean, new wood with sharp tools. Some one preconceived the notion that my hands were all thumbs.

I can remember myself so well as a very little boy standing in a lumber yard, feeling pieces of spruce and white pine, looking longingly at a springy plank 2 inches thick and 16 feet long, and wanting that plank almost more than anything I ever had seen before or since.

Later there were times when I stood for hours with my nose pressed against the glass of the show window of a hardware store, dreaming of myself at a work bench with all of the planes, the saws, the rules, the chisels, the hammers, the screw-drivers that I could possibly want. But I did not ask for them because my family was fully convinced that my hands were all thumbs. I might want to tinker about with wood and tools but they made me feel that sweet smelling lumber was for boys and men who knew how to use it, not for those who had no "talent."

Resigned but discontented I grew up believing there was a great mystery, for instance, about hanging a door. I have seen carpenters breathe on the hinges which they were about to screw into position with the idea that it brought them good luck and that the doors as a result would hang well. It isn't true, of course. There is no mystery about hanging a door. You don't need good luck. You need only know how to do it, providing you have tools of good steel, well sharpened. Today, I believe, I could guarantee to teach my fifteen-year-old boy in two lessons how to hang a door.

It wasn't until I became a husband and a householder that I got myself a tool chest. Talk about it being my hope chest! I really believe it has saved my life time and again—sharp, well designed tools and good, clean, bright wood and the joy of working with them. I learned to put up shelves, hang a door, put new locks on windows and cupboards and build very satisfactory pieces of simple furniture. It's as easy for me to do that kind of thing as it is for me to humor a furnace fire, fix electric lights, or grease the chassis on a car.

Having learned to do those things I wanted to do more. I learned what a tool can do, I, who since my childhood had known that haunting, pungent scent of fresh wood in my nostrils. Most important, however, is something else I learned—I learned that any big job, such as building a kitchen cabinet, is not a mysterious and wonderfully complex task. It is not a battle with wood that will not come to time in your hands. It does not require a mysterious and occult knowledge.

I discovered that you do not stand over a pile of lumber with a saw, a plane and a chisel in your hand and say "hokus-pokus." On the contrary what you actually do is take a small board of the proper kind of wood, make it the right length and the right width and join it to another small piece which you have put through the same process. You keep on doing this, occasionally erecting three or four of the pieces you have put together. When you get through with the job, after a few hours' labor, you have what is called a kitchen cabinet. It is not a kitchen cabinet until you have put it all together and erected it in place. It is a collection of pieces of board, sawed and planed to fit together in various ways.

Really it's as simple as $1+1+1+1=4$.

So I learned that making anything out of wood is like

doing any other job; you need to know a little bit about it, to have the proper tools to do it and then do it little by little and bit by bit.

That is all there is to making anything of wood. You make a little piece of it at a time.

Things Made by Hand are Most Beautiful

Not very long ago I made a lucky purchase. It was a little Jacobean stool, such as they used to have five hundred years ago in Elizabethan England for small boys and girls to sit upon. It is made of oak and it is well worn from countless childish shoes and trousers. It is, I believe, more beautiful than any stool which I could purchase today in a store. The only reason why this old stool, which has seen so many centuries pass, is more beautiful than a stool I could buy in a furniture store, is because it is well made by hand, is simple and rugged in design, is made of most excellent materials, and the wood has acquired the beautiful color the years have brought to it.

The fact is that almost anything which we use can be made stronger, more simple, more beautiful, by loving hands than it can by machinery. There is no reason why a kitchen shelf may not be fundamentally beautiful. There is no reason why a door cannot be hung so that it swings at the touch of a hand and is beautiful because it is simple and rugged.

If you will learn to make an ordinary mortise, to form a dovetail joint, a halved joint, or to plane the edge of a board so that it is square; if you will learn to drive a nail straight, to put heavy screws in oak without splitting the board, and handles on a drawer so that they are straight: your work in wood should be beautiful.

You can go to a store and buy a kitchen cabinet ready for use, well painted, for $50.00 or $60.00. You, yourself,

can make in the evenings, that kitchen cabinet for not over $10.00. You can go to a store and buy a candlestick complete ready for use, varnished and polished, for from 10 cents to $5.00. You can make that candlestick yourself with perhaps no saving in money. But when you have made it and it is standing on the mantelpiece you have always before you as you look at it the memory of a sharp tool cutting into well seasoned wood. Through your hands, and your hands alone, the world is richer by the existence of that object that you can hold in your hand.

That is the satisfaction which the artisan in paint, the artisan in words, or the artisan in steel, stone, glass or wood feels. There is something priceless about it. You have a value that no man can take from you. Let the candlestick become blackened and charred, let it be broken by careless hands and still the joy of its creation cannot be taken from you, it is yours for the length of your life.

CHAPTER II

How to Become Skillful

Craftsmanship is a combination of knowledge on how to use tools and of skill with the hands. An old carpenter has more tricks of the trade than he could possibly teach and no two carpenters' tricks are the same in every instance. These tricks are a part of the day's work. They come from cut and try or the trial and error method. You could start today and in half an hour learn all by yourself several things about tools and wood. If you took a plane to a piece of white pine you would discover shortly that when you attempt to push the tool against the grain you would not make a smooth cut, yet when you push the plane with the grain you make a smooth cut which, with a sharp plane, is almost as smooth as though you had sandpapered it down.

Lesson One. You have learned never to plane a piece of wood until you have examined it to see what way the grain runs. You will learn to plane always with the grain unless you have a special finishing job requiring a special

Figure 1

1. Planing against the grain roughs the wood like stroking a cat's fur the wrong way.
2. Planing with the grain leaves the wood sleek and smooth.

type of work. There is no way of learning such facts except by trying.

The other factor in craftsmanship is natural skill with the hands. To become a skilled workman in wood requires practice for two reasons—you learn to handle tools delicately and firmly, as a pianist learns to strike the notes on his keyboard to produce precisely the effect he wishes; the other is to learn by trial and error the better ways of doing every single little thing.

There is no real short cut to craftsmanship and one of the very greatest advantages of working with wood is that you learn this fact and are extremely likely to guide your life in the future according to these principles. You learn a great deal about life and business from a kit of tools and some wood.

What This Book Can Do

No book could possibly give you all the tricks of the carpenter's trade. They have to be learned at the bench. But there is no reason why you cannot learn all you need to know for the home use of a good set of tools. You can teach yourself while making things which you wish to use.

It is the purpose of this volume to give you fundamentals which will enable you to get the most fun out of tools and to achieve the most skill.

And most important of all, by using this book to help you make things at home, you will be adding to the richness of your own life.

(If there are particular things which you wish to make, the publisher of this book can tell you how to procure working drawings, which, with the aid of this volume, will enable you to build almost anything you would care to undertake.)

CHAPTER III

Let's Make Something

Have you ever sat behind a portrait painter or have you ever watched a sign painter working on a billboard? He walks boldly up to his canvas or board, cocks his head on one side, seizes a brush, and puts some paint upon it. Glancing at his model or a copy of the design which he is going to reproduce his eyes travel back to the board where the picture is to be and he makes a long sweeping mark with the paint he has put on his brush. The mark is utterly meaningless to most of us. So is the second splash of paint which he applies and probably the third and the fourth. To most of us what he is doing is an utter mystery until suddenly his design appears perhaps half completed. It is a common vaudeville act for an artist to stand on the stage and to carry out this action, completely mystifying his audience until the last line is made, when suddenly the picture, upon the completion of that last line, jumps into being and exists and you recognize what it is he has created.

Watching a carpenter you find that precisely the same thing happens. When he starts to make a chair he selects a piece of wood, examining it carefully. His next step is to take a pencil and put lines on the piece of wood. He follows this by placing it in a vise, picking up a plane about 14 inches long and slicing off long, thin shavings of spicy wood. No one on earth, unless he were a mind reader, would know what he was planning to do. But rest assured that there is in the worker's mind a very definite plan and that he knows exactly what he is doing. He knows how long the legs of the chair will be; he knows how wide and how deep the seat will be; he knows the

dimensions he is going to use and the shape of the chair; he knows what joints will be required; he knows what nails he will need; what screws he will need; he is ready to use the glue. The chair, or the stool, or the table, or the window frame which he is about to construct has already been designed. The fact that you do not see a blueprint means nothing, except that he is working from his own head. Being an experienced craftsman, he will not cut into clean wood until he knows exactly what he is going to do.

Unless you want the help of some one who is more skilled in design and in the problems of woodworking than you are, you don't have to have a working drawing from which to work around a house. A working drawing or a blueprint made from a working drawing simply acts as a guide. If you use no working drawing, if you are merely making a shelf to put in some particular place, you do not need the help of some one else, but you should put on paper a rough drawing of what you are going to make before you turn the first shaving. If you are "eye-minded" you will have no difficulty in drawing a little picture of the shelf and marking on it the measurements which you wish it to have so that it will fit in the space for which you are designing it. If you are not "eye-minded" you can accomplish much the same result by listing the various pieces of wood in the product, with the dimensions you wish them to have when they are done.

Obviously the shelf must have a certain width and a certain length. It must have something to hold it in place: metal shelf brackets or wooden brackets which you yourself make. Your shelf obviously must be a little wider than the brackets. There must be screws or nails to fasten the shelf to the bracket and to fasten the bracket to the wall. The brackets must take a certain position.

They must go into fairly solid wood for they will not hold well in plaster. You know, of course, from your childhood how to tap the wall and to listen and locate the solid wood and the hollow places behind the plaster.

Settle all your problems of design in advance. You may add decorations to your shelf after it is ready to put up but changes in its basic design will undoubtedly result in a poor job and a great deal of extra work if they are made after you have finished planning the work and have started cutting. No one could object if you decide, when you see the finished board, to champfer the corner which is in full view. (Champfering, in case you don't know, is merely putting a bevel on the piece of work.)

When you have purchased your tools and decided to make something, the first step always must be to design the object. When you actually start work your actions will appear just as mysterious to the casual onlooker as the actions of the experienced carpenter.

After you have made your design and your decisions upon dimensions you need next to choose wood which is suitable for the purpose. For the inexperienced amateur there is no wood in the world which is more fun to work with, more satisfactory in the results obtained, than white pine, and next to this poplar, called white-wood. It isn't expensive and often you will find there are wood-working plants in your neighborhood where you can pick up scraps at very little cost. If you are going to put up a shelf you require a board large enough to cut down into the dimensions you intend to use. Such a board is not expensive. For an ordinary closet or kitchen shelf you can undoubtedly buy enough clear, white pine for a dollar to do your whole job.

The reason I suggest white pine is because it usually is clear. Its grain is quite straight and the wood quite soft. It does not splinter easily. With sharp tools it cuts as

nicely as cheese. It has good structural strength, too. While an oak shelf might require only two brackets to keep it from sagging, and a white pine shelf requires three, it would take you three times as long to make a shelf from oak.

The tools for such simple household tasks as making a shelf are the same tools required for making a bench or even a kitchen cabinet. (Of course, a skilled mechanic could make a shelf and put it up with nothing but a hammer, a few nails and a pocketknife. To make a shelf quickly and easily requires several different tools. Almost every one of these tools is really essential to even the simplest job.)

Some of the tools required you may have around the house, although most household tools are badly damaged after they have been lying around for a few weeks. Screw-drivers are used to pry open windows, chisels to open tin cans, blades of planes to pry out tacks. The usual domestic hammer is a tack hammer instead of a good honest tool for driving tenpenny nails. But whether or not you are able to fix up the tools around the house it is important that you have a place to keep them, a tool chest which is their respected domicile. Best to do, of course, is to purchase a standard tool set which will serve you for a lifetime.

Such a set containing everything you need for working around a house, for putting up shelves, for making a kitchen cabinet, for repairing a cellar door or for bracing a roof costs only about $25.00, including a chest for keeping the tools in their proper places. You could get along with a tool chest costing even less and having fewer tools. But the tools you really need to have the most fun are contained in a $25.00 tool chest, such as can be bought at almost any hardware store. It contains the following tools:

1 Hammer, 13-ounce.
1 Screw-Driver, 5-inch.
1 Screw-Driver, 3-inch.
1 Rule (Zigzag), 4-foot.
1 Bit Brace, 8-inch.
1 Auger Bit, $\frac{1}{4}$-inch.

1 Saw (Hand).
1 Try and Mitre Square, $7\frac{1}{2}$-inch.
1 Marking Gauge.
1 Plane (Bench), 8-inch.
1 Chisel, $\frac{1}{4}$-inch.
1 Chisel, $\frac{3}{4}$-inch.
1 Spoke Shave.
1 Auger Bit, $\frac{3}{8}$-inch.
1 Gimlet Bit.
1 Screw-Driver Bit, $\frac{5}{16}$-inch.
1 Pair Pliers.
1 Awl.
1 Nail Set, $\frac{2}{32}$-inch.
1 Vise.

The Need of a Bench

As a matter of fact the first thing which you make really should be a bench because without a bench you cannot expect to do the kind of work that will satisfy you. And

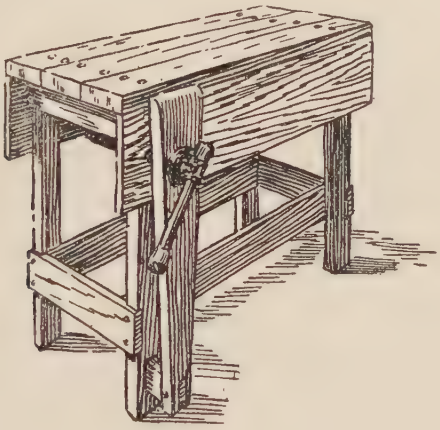


Figure 2

since the bench need not be well finished and since it should be made of fairly heavy materials it is perhaps always the best thing for the amateur to undertake when he plans to see what he can learn and how much fun he can have with wood and the tools with which to work it.

This is the reason why the next chapter has been devoted to the building of a bench. It takes for granted that you have a few tools. It takes for granted that you have a place

in which you can work on holidays, or in the evening or during your vacation period.

Go to the next chapter and follow through. When you have finished you will have created something which you will be proud of all your life.

"The workbench is finished, Mother."

CHAPTER IV

This Will Be a Bench

The only reason why it should bother any one who has some tools to tackle making a bench as his very first job is because he hasn't a bench on which to make his own. Nevertheless that can be overcome by the aid of two or three kitchen chairs and a kitchen table. There is no fine work required to make a bench which will be a very serviceable piece of shop equipment. If you make a few mistakes—and you won't have much fun unless you do—it won't seriously matter. What you are actually producing is a big strong table, with a vise on it and four legs of equal length. Most important, there isn't any easier way to learn to use tools than to start right in on something that you really want. Every person who follows through carefully from the beginning of the operation to the completion of the finished product will have learned all the basic things about using a saw and hammer, a plane and a chisel, as well as a brace and a bit with which to bore holes. He will have seen how a simple joint is made. He will have had the experience of going to his lumber dealer to get the materials, to the hardware store to get the hardware needed to complete the job, experience, adventure, instruction and accomplishment, all for the price of one sturdy bench.

Like every carpentry job or cabinetmaking job all there is to do is to cut materials into their proper lengths, widths and thicknesses, make the necessary joinings and put the whole group of sticks and boards together. If you do these things, one at a time, and do each thing carefully, you will do a beautiful job.

The best bench (for practical use) that we are talking

about is 5 feet long and stands 32 inches high. It has a vise and you can put on the top of it various little devices as you wish, such as a frog for holding boards upright, a bench stop for surfacing boards, a bench hook for holding work which you are sawing or chiseling, and perhaps also a block on the front of the bench for working with wider boards than the block on top will permit. As a matter of fact, this will make a bench fine enough for a real carpenter. But at the moment of starting don't be burdened with the thought that you're making a piece of shop furniture. All one has to worry about in the beginning is getting some boards. Then you cut them up with sharp tools.

The first question, of course, is what wood must be bought from the mill or lumber dealer. There are only seventeen pieces to be cut and fitted. But when you make up your list you have to buy such pieces as your dealer has in stock longer of course than the pieces will be as you finish them. When you figure out by making a sketch or drawing of the object you are going to make, you always find that you need to buy only a few pieces of wood. For your bench you will need only five pieces of wood from your dealer, even though eventually you are going to make seventeen pieces from these five.

The bench is going to get some hard wear. That means that you will require a certain amount of hard wood which will stand strain and rough usage. As you probably know there are really just two kinds of wood—hard and soft. Hard wood takes a fine polish. Some of the hard woods are relatively soft. Some of the soft woods are relatively hard, but any lumber dealer or man about a lumber yard can tell you the right wood to use for various purposes. Certainly I never bothered to learn much more than the general classifications, although some of my friends who have the germ very badly can discuss at length

the difference between kinds of pine and when to use oak or maple or chestnut.

In the case of a bench we know what parts of it must be strong. Therefore, we must use strong, tough wood. You might use oak for it is strong and very hard. But oak has a tendency to split. Mahogany is too expensive. Pine is too light. What is best for a job like this is maple.

Your botanist would tell you that oak is "ring porous." If you will look at the end of an oak board you will see that the rings by which you can count the age of the wood are so porous you can actually drop water into them. This is what makes oak split so easily despite its excellent strength and toughness. Maple, on the other hand, is "diffuse-porous." It has small pores of various sizes, but these are scattered irregularly through the rings of growth so that the piece of maple is much harder to split in actual use. Almost any lumber yard can supply the single piece of maple you need for your bench.

Maple, then, for the front board of the top of your bench on which you will plane and saw when you have put it to use. It is also best for the jaw of the vise and for the leg on which the vise is rigged, which leg will take the strain of your operations. At the bottom of the vise is a piece which is called the vise lock and this, too, should be of maple. But if maple is not obtainable you can use quite safely almost any of the hard woods. The thing to do is to tell your lumber dealer what you want your wood for, so that, if he cannot supply you with maple, he may provide a good substitute, such as birch.

The wood demands of the rest of the bench are simple. Almost any wood will do but remember soft woods are much easier to work than others. White-wood is undoubtedly about the easiest for this purpose. It is a little expensive compared to such wood as fir, but so small an amount is

required to make a bench that the difference in cost does not really count. What you actually want are good pieces of wood which are straight and well seasoned, particularly which are "clear." By clear I mean, comparatively free from knots. Knots are the bane of the amateur workman. I never have been able to learn to saw, or plane, or chisel a piece of knotty wood and if the wood is for use in a finished piece of work it presents the disadvantage of being more difficult to finish.

Of course you cannot buy wood which is absolutely clear unless you go to great trouble and expense. What the clever carpenters do is accept lumber which has a few knots in it, calculating to saw out their individual pieces so that the knots do not come into the work but are thrown away as waste.

One of my friends when he first began to work with tools did a thing which seemed to me extremely ingenious. He went to his local lumber yard and got a small piece of every kind of wood they had. That made a bundle of twenty or thirty sticks. He got the lumberman to label each one for him and then he went home and tried them all out, making a little memorandum for himself, which told about the various difficulties and the various points of advantage from his own experience. What he had to say about one of the soft woods—Georgia pine—was more profane than logical.

Georgia pine is cheap, usually, but it is full of resin. It is as hard as most hard woods and very difficult to saw, let alone to plane or chisel. Yellow pine often known as long leaf pine is halfway between white pine and Georgia pine in its difficulty of use, but it has the advantage of being very strong and serviceable for things like the legs of a bench.

Most of us who are interested in the shop are not particularly interested in the way these various woods grow. For, offhand, it is enough to know that the soft woods, as we call them, are all of the same general family, usually known as pine woods, although this is not an accurate name for them. The hard woods are from the trees which lose their leaves in the winter time.

But the thing to do is to follow the procedure of my friend. Try the various kinds which your lumber dealer carries, with your own tools. You take the advice of the lumber dealer after you've told him what you wish to use the wood for, of course, but the first mentioned is the most satisfactory. You can use any wood you like for the bench because it is a rough piece of work and because it should always be built with a large factor of extra strength. But the easiest and best woods that you could choose are maple for the parts that take the strain and white-wood or yellow pine for the rest of the top.

Here is what the dealer should be asked for on the bench we are describing:

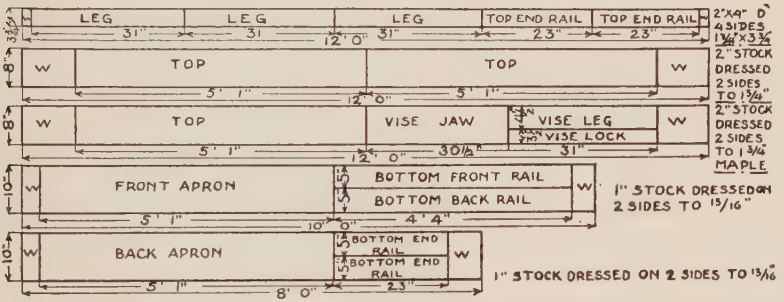


Figure 3

1 piece 2″ thick x 4″ wide x 12′ 1″, dressed on 4 sides to 1¾″ thick x 3¾″ wide.
1 piece 2″ thick x 8″ wide x 12′ 1″, dressed on 2 sides to ¾″ thick.
1 piece 1″ thick x 10″ wide x 10′ 1″, dressed on 2 sides to 13/16″ thick.
1 piece 1″ thick x 10″ wide x 8′ 1″, dressed on 2 sides to 1 13/16″ thick.
(Any soft wood preferably white-wood.)
1 piece maple 2″ thick x 8″ wide x 12′ 1″, dressed on 2 sides to 1¾″ thick.

The lumber you order is made up in the form of a "bill of material." After a little experience you can make up your own bills of material which you can hand to the lumber dealer, or the mill where you buy your wood.

At the time you buy these materials it would be very wise to go to the hardware store and buy the rest of the material you need. This is as follows:

3 dozen 2" No. 12 Flat Head Bright Screws.
1 dozen 3/8" x 5 1/4" Square Head Bolts.
10 3/8" x 5 1/4" Square Head Bolts with Washers.
1 Vise Screw, 1 1/8" x 18", iron.

When you have all these materials assembled and your kitchen table to use as a temporary bench and a couple of kitchen chairs to lay things on when you are sawing you are all ready to begin. Now is the time to get out your pencil, your try-square, your marking gauge, and show these five pieces how they are to become seventeen pieces. Take the piece of maple and with your pencil, try-square, and rule mark on its surface just what you are going to make out of it. You want a board for the top which will be 5 feet long when it is finished.

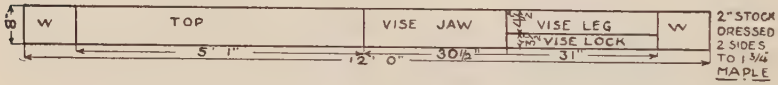


Figure 4

Don't cut it exactly 5 feet long because you are just doing rough cutting. Mark it out instead to be 5 feet 1 inch long. Some of the board on each end you will leave for waste since the end of a board as you get it from a lumber dealer is almost always a little bit cracked, black-

ened, and checked. Then you mark out the length of board you need for the vise jaw. In the bench we are describing this will be $29\frac{1}{2}$ inches, but now we leave a little extra and mark it out roughly as 31 inches and on the same board we mark out the vise leg and the vise lock. The leg is to be $30\frac{1}{4}$ inches long and $3\frac{3}{4}$ inches wide, so you can give it something extra on the ends and on the sides. The same thing is true of the vise lock.

This is a sample of the way you always use a piece of material as it comes from the lumber dealer. You make as many pieces out of it as you possibly can but you always allow extra space for the finishing process. I remember so well that when I was first trying to handle tools I didn't know about this extra length and width. That meant that every mistake I made was irretrievable. I tried to cut each piece as though it were a finished piece. There practically isn't anybody good enough to do that because we all occasionally make a mistake. Another way I got myself into trouble was that I did not mark each piece as I cut it out. I found myself with various sized sticks and boards when I got all through and I didn't know where half of them went. It was like putting together a watch and having a couple of wheels left over.

The fact is, as I suggested in a previous chapter, no one can make an object out of wood without a definite plan. You can mark your plan with numbers, or you can write on each piece of wood as you saw it out exactly what it is for. But don't try to carry each piece's purpose in your head. No head is that good. You won't have any fun. Somebody will call you to the telephone or send you down to the grocery store to get some butter and when you come back you may have forgotten whether you were cutting out a vise jaw or the leg. The illustration (Figure 3) shows this clearly.

The actual marking on a piece of wood is perfectly simple in this roughing-out process. With a good big carpenter's pencil you can do it quite roughly at this stage of the job since you are allowing waste. Most workers with wood do this free hand. Starting at one end of the board figure how much must be sawed off, because it is not suitable for use. Then you draw a pencil line across the width of the board with the aid of a square and measure from the line with your zigzag rule the length of piece you are going to use—in this case 5 feet 1 inch—and draw another line across. In Figure 4, when you come to the other end, which requires a lengthwise cut as well as a crosscut, you can draw your lengthwise line roughly but accurately enough by putting down with the rule the two points which you wish to connect with your line. Then you hold the pencil firmly in your hand and run it along down the middle with your thumb as a guide on the edge of the board.

This method can be used right straight through for rough marking after your fingers become skillful. You use a marking gauge in exactly the same way as you use the pencil.

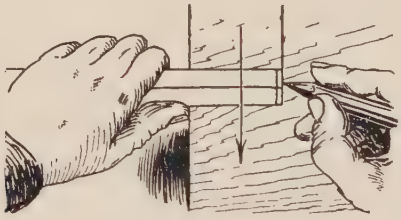


Figure 5

The rule and pencil may be used like a gauge.

The photograph on next page shows how you hold the gauge to make that kind of a mark, and the results of course are most accurate.

In this case, when you are cutting up five different pieces to make seventeen you mark them all out, one after another, before you cut into anything. From the piece of 2 x 4 you mark three legs and two end rails. From the piece of 2 x 8 you mark merely the two top boards which are to form the back of the top of your bench. The bench as you see in the sketch (Figure 2) has three top boards, the first

Figure 6

1. Roll the gauge outward so that the spur drags. Press the block tightly against the wood.
2. Grasp the gauge like a baseball.
3. Then thrust the thumb out and push gently forward.

one coming out of the maple stock. From the long piece of 1 x 10 you mark the front board or apron, and the two long rails which connect the legs at the bottom. From the short piece of 1 x 10 you mark out the back or apron board and the two short rails which connect the legs at the bottom.

When you have these pieces all marked out you can see for the first time where everything is to come from. The illustration (Figure 3) shows this clearly. To a person of imagination, and one who has had a little experience with a saw and a plane, who has used these tools occasionally to cut and smooth carefully and accurately, it really wouldn't

be necessary to go much further in explaining how the bench is made. With the aid of the illustrations shown and those to follow, showing how the small pieces are cut out of the large pieces, he can go straight ahead and make a mighty fine bench. But even such a person may not have picked up various little details which are easy enough to learn. So without going into the complete detail of

Figure 7

1. Guide the saw against the thumb when starting. 2. Draw the saw back to start it.

every single operation, but handling the whole thing in a very much simplified way, I can tell you a good many things which I have picked up from my own experience and from skilled craftsmen, which save any one a great deal of time and even irritation.

Take the detail of sawing one of these boards in two or sawing the end off it with a crosscut saw. You might think offhand that anybody can take the saw and saw on a straight line but it's not true. I have spent a good deal of time first and last in my own abysmal ignorance trying

to saw in a reasonably straight line and succeeding chiefly in cutting a fine gouge in my thumb. The fact was that I did not know that in order to start my line there was, and is, only one way to do it. Grasp the handle of the saw firmly with the right hand, with the thumb and the index finger touching the side of the handle. Now draw the saw up at least once and probably several times with the thumb of the left hand guiding the blade on the wood where the cut is to be made. It should be drawn up slowly and care-

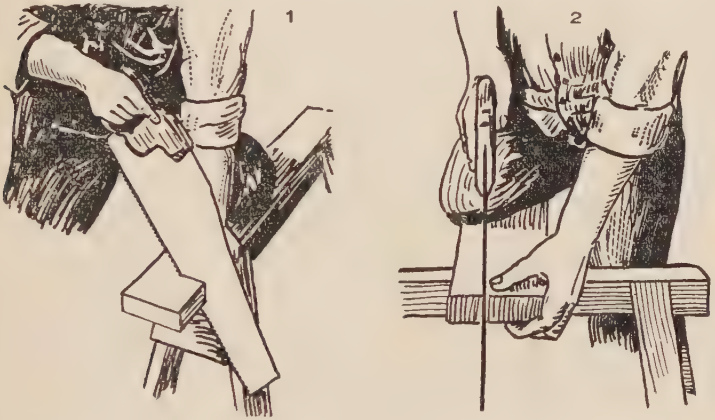


Figure 7½

1. Crosscutting on a sawhorse. 2. Ripsawing on a sawhorse.

fully at exactly the point you wish the cut to begin. If you try to do it quickly the saw will jump and present you with a healthy cut thumb rather than a healthy cut board. Even that is not so bad as it is if you try to start the cut by pushing down on the saw instead of pulling up because before you may push down you must have the little guiding cut in the edge of the board. It is this down stroke which does the actual cutting when you are going full blast.

Another thing. A saw has thickness of its own. Therefore you do not start in the middle of the line. You have

to start on the outside of it. What you wish to do is to saw roughly near this line, leaving the line on the board to be cut to exactly with the plane when you are doing the finishing that follows the rough cutting out.

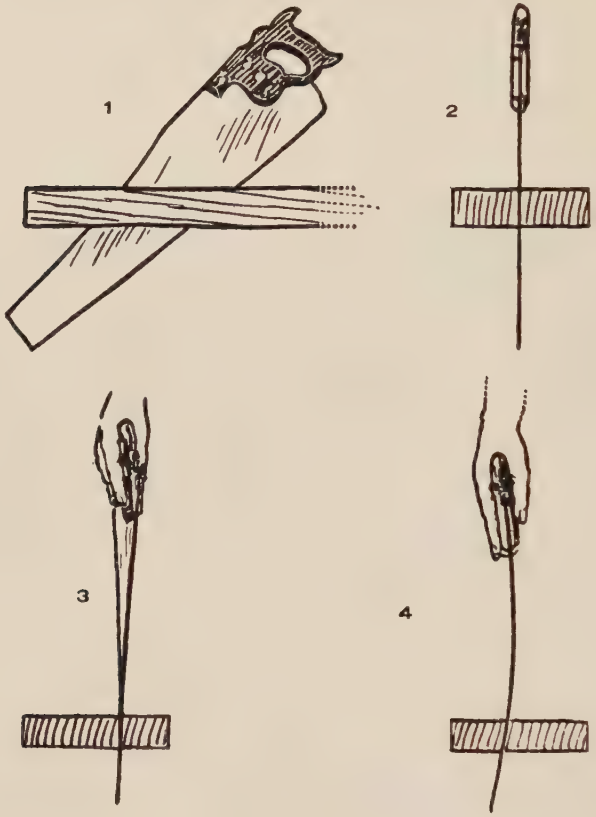


Figure 8

1. Hold the saw on a slant when cutting.
2. Keep the length of the saw square with the face of the wood.
3. If the saw leaves the line, twist the handle and bring it back to the line.
4. If the saw is not square with the face of the wood, bend it slightly and gradually straighten it.

You should take hold of the saw very firmly after you have established the preliminary cut by pulling it up two or three times. If you hold it loosely it is very difficult

to saw on a straight line and your arm becomes tired very quickly. As you push down the saw bites in beautifully and if you are holding it firmly and giving a little pressure to the blade, making a firm, fairly rapid movement, your cut will start easily and nicely. The blade itself must be vertical or at right angles to the board to make a square cut. You can easily catch on to this if at first you carefully sight above and to one side as soon as your cut is started or test with a try-square.

Figure 9

Hold the end when crosscutting.

A long, slow, easy stroke is best, using the saw from the tip to the hilt, putting pressure only on the down stroke, with the board held firmly. The saw itself should be held at an angle of about forty-five degrees with the surface of the board for the most efficient cutting. The teeth don't have a chance to do their real work unless you hold the blade at approximately the suggested angle.

If you are sawing a long board stretched between a couple of kitchen chairs, in making your bench, you've got to hold up the weight of the board with your left hand as you approach the end of the cut. If you don't, the saw will bind and be impossible to push through the stick as you

approach the finish of your cut. The weight of the board closes the saw cut on the saw. The saw sticks and makes you feel as though there's no remedy save jumping out of the window unless you do hold up the weight with your left hand. Then it saws easily. Moreover, if you do not hold it up a piece of wood will break off before the saw finishes the cut and leaves you a problem in the shape of a piece of broken wood, a problem that there may be nothing you can do about it but to glue it back into place.

Of course, it is not good practice to cut with the grain with a crosscut saw. The ripsaw works much more rapidly and will cut with the grain quite beautifully, using the same methods that you use on the crosscut saw for sawing across the grain. Here, then, perhaps is your first encounter with the grain of wood. Nobody can have any fun with wood until he understands how to use tools in relation to the grain. Trying to plane a piece of wood against the grain is no different than rubbing the fur of a cat the wrong way. The cat doesn't like it and after you have rubbed him the wrong way a few times he will probably scratch your arm vigorously. Neither does a piece of wood like it. Your tool will bite in and jump, raw chips will be torn off, and it will be impossible to make a smooth, straight, square surface. The first thing which any worker with wood does before he touches a tool to the piece is to examine the grain. He does it so automatically that if you asked him if he had looked which way the grain runs he probably will say no. But rest assured he has looked. Otherwise he could not work with it at all.

A crosscut saw is made to cut across the grain. Its teeth are small and are filed to a point. They literally score two knife-like lines and grind the wood between into granules. The rip saw, on the other hand, cuts through more as a chisel does. The teeth of both saws are alternately bent

or set, one to left and one to the right, which insures a "kerf" or cut wide enough to keep the saw from binding.

Practically everything that grows has a grain. You will find it in beefsteak, in leather, in a grain of wheat, or in a piece of wood. Always it is true that it is more difficult to cut and smooth across the grain than it is with the grain. You can whittle smoothly with a pocketknife if you go with the grain. Go against it and the knife stops and you have made a deep angular cut when you merely wanted to cut a shaving. Thus this great importance, that before you make any cutting operation you determine which way the grain of your wood runs so that you can work with it and not against it.

After you have laid out the rough size on the board for your bench, mark what each part is and then cut them out with a saw. Your rough work is done and you are ready to begin the finishing. Most hard work from here on will be with the plane although there are some holes to bore, some screws to drive and some joints to make with the aid of the saw and the chisel.

There is one square hole to be cut which is known as a mortise. There is, of course, also the job of marking accurately on each one of the rough pieces you have cut out the exact sizes that they are to be. These sizes are already roughly determined, such as the 2 x 4 pieces used for the legs and the rails which connect the legs at the top. These pieces which are dressed when you buy them don't need any more work except to cut the notches for the joints. The piece of maple for the vise lock and also the four bottom rails will all have to be planed to smooth them up properly, although if you are doing a very rough job this would not be absolutely necessary if you have sawed reasonably straight in cutting them out from the boards. A good workman wouldn't think of having one leg bigger

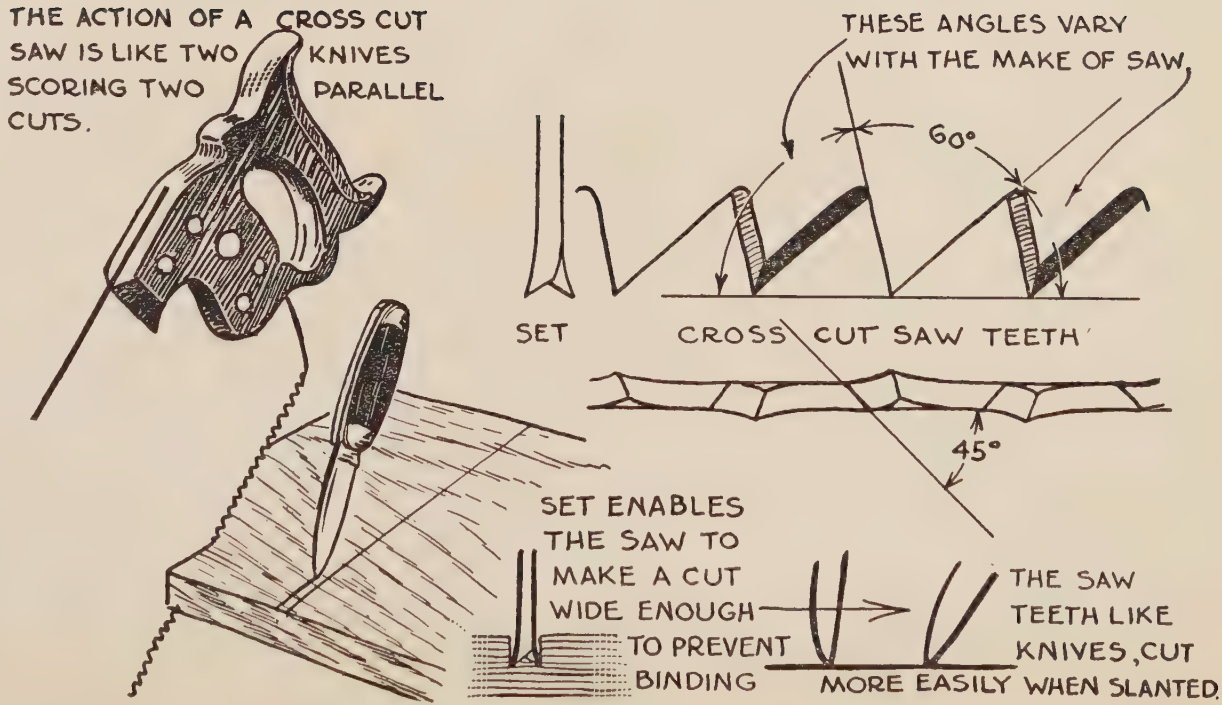

THE ACTION OF A CROSS CUT SAW IS LIKE TWO KNIVES SCORING TWO PARALLEL CUTS.
THESE ANGLES VARY WITH THE MAKE OF SAW,
60°
SET
CROSS CUT SAW TEETH
45°
SET ENABLES THE SAW TO MAKE A CUT WIDE ENOUGH TO PREVENT BINDING
THE SAW TEETH LIKE KNIVES, CUT MORE EASILY WHEN SLANTED

Figure 10

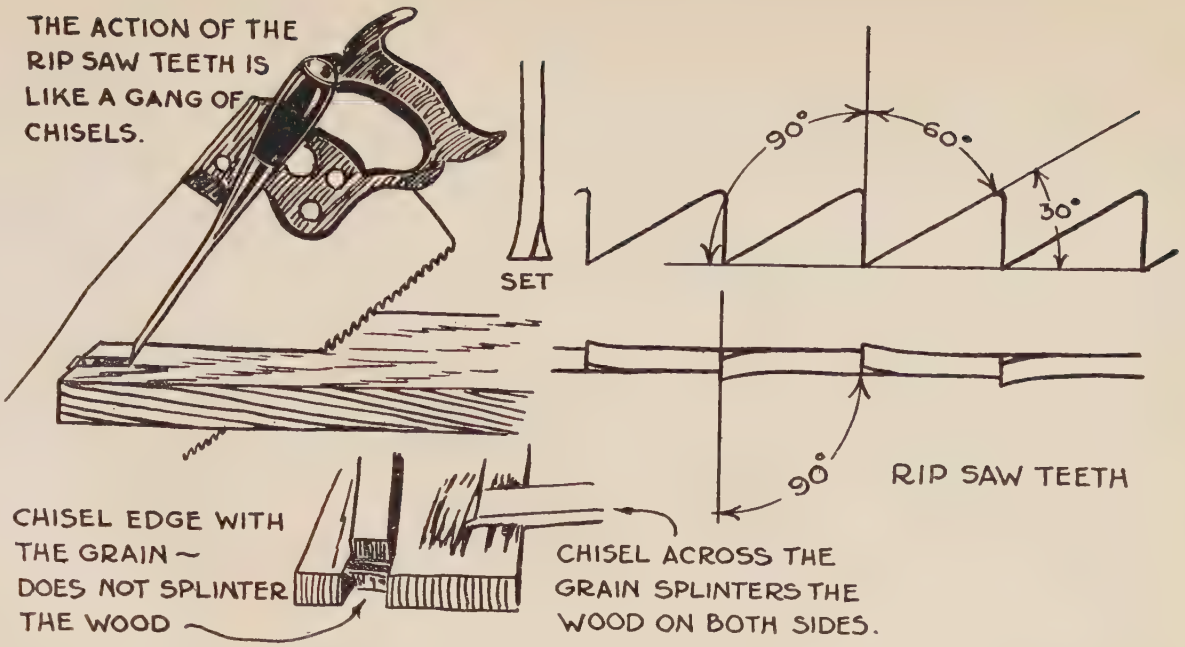

THE ACTION OF THE RIP SAW TEETH IS LIKE A GANG OF CHISELS.
SET
90°
60°
30°
90°
RIP SAW TEETH
CHISEL EDGE WITH THE GRAIN — DOES NOT SPLINTER THE WOOD
CHISEL ACROSS THE GRAIN SPLINTERS THE WOOD ON BOTH SIDES.

Figure 11

than the other three, and since we are learning and having fun with this job anyway, by all means dress down the maple vise leg.

You always use one of the milled surfaces from which to work, selecting the best one or planing one surface true to be used as a working face and proceeding from that with your square. The first step you actually do is to mark the surface or working face and work from there on. For this particular bench use the table given below, showing the exact dimensions that every piece is to be when it is finished. All of these sizes should be marked on each piece before you begin to do the finishing cutting. Here they are:

Number of Pieces	Name of Part	Thickness	Width	Length
3 (1 Maple)	Top	1 ¾″	8″	5′
2	Apron	13/16″	8¼″	5′
4 (1 Maple)	Legs	1 ¾″	3¾″	30¼″
2	Top End Rails or Stretchers	1 ¾″	3¾″	22⅜″
2	Bottom End Rails or Stretchers	13/16″	3¾″	22⅜″
1	Bottom Front Rail or Stretcher	13/16″	3¾″	4′ 3″
1	Bottom Back Rail or Stretcher	13/16″	3¾″	4′ 3″
1 (Maple)	Vise Jaw	1 ¾″	7″ tapering to 4″	29½″
1 (Maple)	Vise Lock	1 ¾″	2½″	16″

Almost every one will tell you that using the plane, which you must now do, is probably the most fun in woodworking. A plane is nothing more or less than a chisel set in a block of wood or metal so that you can use both hands and work much more rapidly, taking off at each stroke a very thin shaving. Now is the time when you begin to feel the real joy most keenly,—the smell of the wood rises in your nostrils, beautiful curling shavings rise from the bit, the surface behind the plane (providing you are planing with the grain as you should be) is smooth and slick.

Before adjusting the plane it may be best to first inspect the blade. By removing the lever cap you will notice that the blade can be readily removed from the plane. The blade has a cap iron screwed to it which should rest slightly back from the cutting edge on the unbeveled side. The cap iron acts as a shaving deflector. The sharp edge of the cap iron and the small flat surface that bears next to the cutter, should lie tight along the entire width of the blade when they are screwed together. This prevents shavings from working between them.

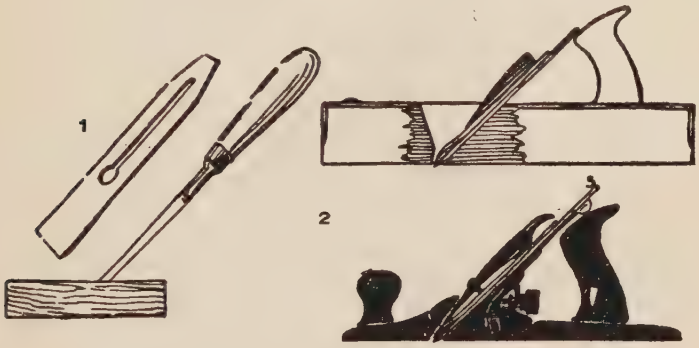


Figure 12

1. A plane is a chisel blade with a guide to regulate the cut.
2. Iron and wooden planes are fundamentally similar. Improved material, shape and adjustments make iron plane preferable.

To replace the blade in the plane be sure to have the cap iron on the unbeveled side of the blade and the cap iron uppermost in the plane. Replace the lever cap locking it with the small cam at the top.

You will now want to adjust your plane for planing the working face if you do not have a good milled surface and for planing an edge square to the working face.

Hold the plane by the knob at the front end, bottom side up, in the left hand with the bottom or sole level with the eye. With the right hand move the adjusting lever to the right or left until the corners of the blade are parallel with

the sides of the throat. Then turn the adjusting nut until the blade slightly projects through the throat and above the bottom of the plane. This may be determined by touching the sole across the throat lightly with the fingers. A common mistake is to set the blade too far out. Take off real thin shavings, not thicker on one edge than on the

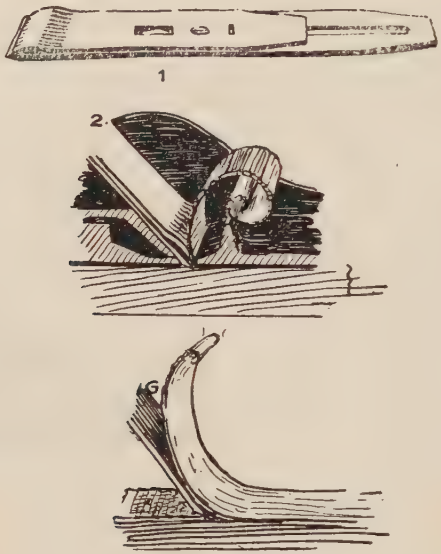


Figure 13

1. Set the cap of the double blade near the cutting edge for hard wood—farther back for soft wood.
2. The combined action of the cap and the toe of the plane in pressing down the wood bends the shaving and prevents the wood from splitting ahead of the cutting edge.

other, and you will obtain better results without gouging the work or clogging the throat of the plane with the thick shavings.

Take a firm position when beginning to plane in front of your bench or table with the left foot forward.

Carefully proceed to get a smooth square edge that is straight by sighting its length and testing for squareness frequently from the working face with the try-square.

Planing the working face smooth and flat was probably easy but making the edge square is no more difficult. It requires nothing more than a little bit of practice. If your

Figure 14

Sight along the bottom of the plane. Let the blade project a hair's breadth and set the corners evenly.

hands are skillful enough to hold the plane square to the working face you will go rapidly through the operation.

Figure 16 shows the successive steps in squaring a piece of wood.

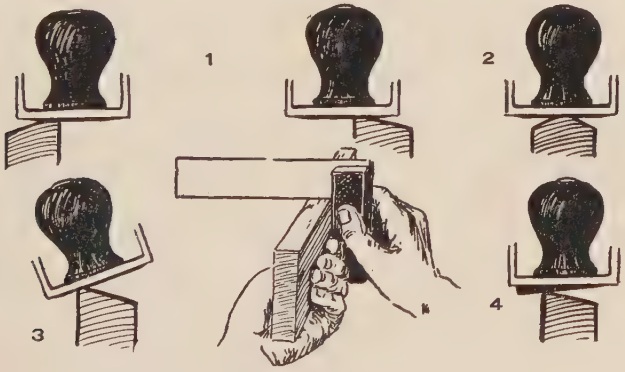


Figure 15

Hold the plane level when planing a square edge.

1. Hold like this when the wood is high on the right or left.
2. Hold like this when the wood is high in the center.
3. Do not tip the plane this way.
4. Do not set one corner of the blade farther out than the other.

Outside of having your tools sharp and set to take a fairly fine shaving and holding the tool as square as you can while you work, there is really little to be thinking about when it comes to planing except that at the beginning of any

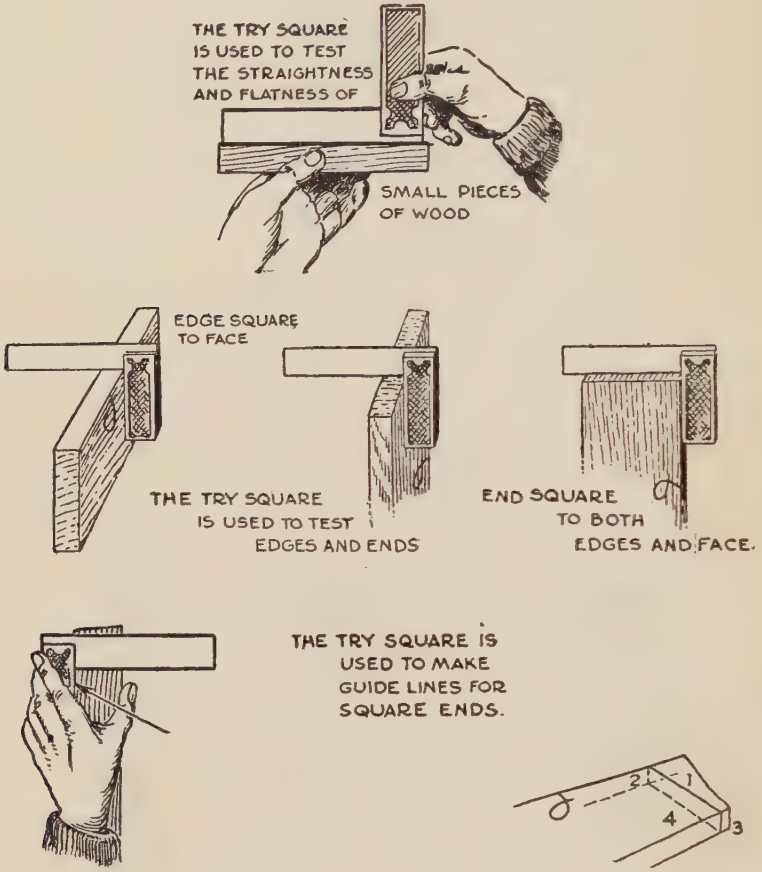


Figure 15½ a b c

stroke you put a little more pressure on the knob of the plane with your left hand than you do on your right hand. In the middle of the stroke the pressure is equal. At the end of the stroke you apply pressure with your right

hand and practically no pressure with your left. (These directions are for a right-handed user.) Thus you make a cut of approximately the same thickness from the beginning to the end and insure the straightness of the edge to the very ends.

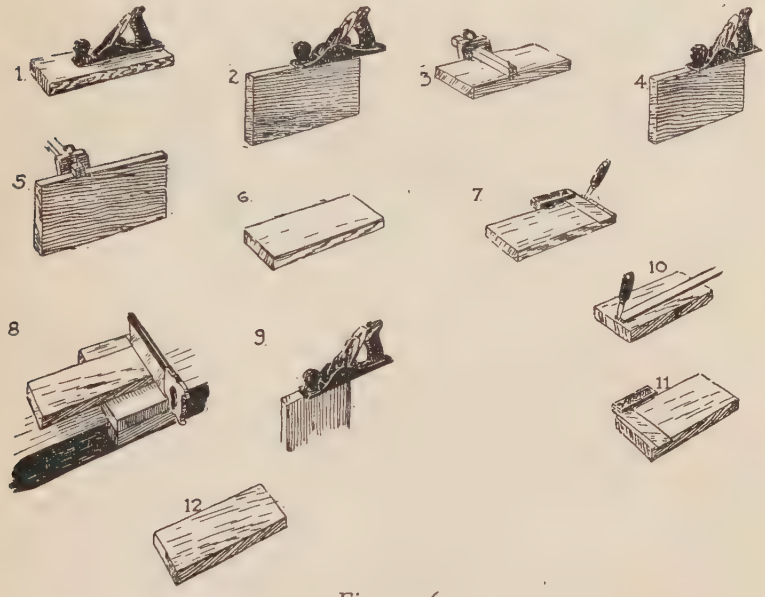


Figure 16

Steps in truing up stock.

1. Plane work face straight, flat, smooth.
2. Plane work edge straight, square, and smooth.
3. Gauge line for second edge, marking width.
4. Plane second edge true.
5. Gauge line for second face, marking thickness.
6. Plane the second face true.
7. Mark guide line for square end on four surfaces.
8. Saw and plane end. Saw end square to line, allowing a little waste wood for planing.
9. Plane true to line, square to both work face and edge. Plane from the edges toward the middle.

10 and 11. Measure length from square end and mark guide lines for the second end on four surfaces.

12. Saw and plane the second end true like the first one, reducing the wood to length.

The following order may also be used: 1. Work face. 2. Work edge. 3. Work end. 4. Length and second end. 5. Mark width and plane second edge. 6. Mark thickness and plane second face.

If the wood has an irregular grain it may be necessary to plane one end of the board in one direction, and the other end in the opposite direction, but ordinarily and particu-

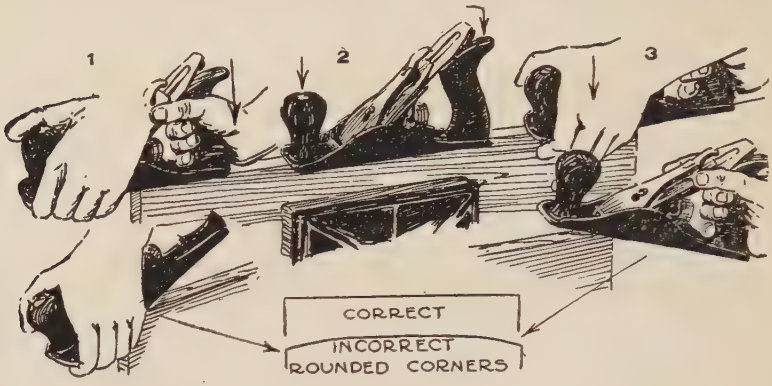


Figure 17

1. Down pressure on the handle at the end of the stroke.
2. Pressure on both knob and handle.
3. Down pressure on knob at start to keep plane straight.

larly in a fairly rough job, like the bench, this won't bother you.

The first cutting on a long surface really requires a jack plane, which is ordinarily 14 inches long.

Figure 18

Its long bottom surface, called the sole, rides over the low places and enables you to take off the high places, preserving the general plane of the surface.

The finishing is usually done with a smoothing plane which has a shorter sole. For many workmen who are tubbing around the house the so-called bench plane which is 8 inches long serves both purposes adequately. For

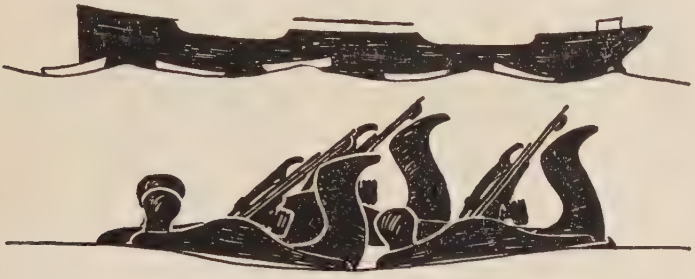


Figure 19

A short plane follows the shape of the wood as a small boat rides over the waves and into the hollows between.
A longer plane does not follow the hollows.

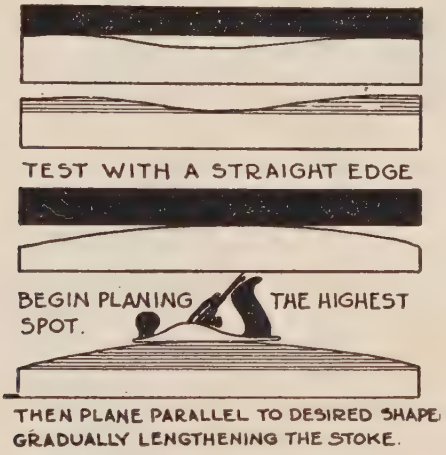


Figure 19½

cutting across the end grain and smoothing up the ends of any piece of wood a small block plane about 6½ inches long is the proper tool. The cutter of a block plane is set at a low angle and consequently cuts the end grain more easily. The first time I tried to use one I knocked off a quarter or

half an inch at the end of my stroke, spoiling the piece of wood upon which I was working. This was because working across the grain in this fashion, even with a little block

Figure 20

1. Avoid breaking corners on end grain by planing from the corner to the center.
2. Do not plane from the center to the corner.

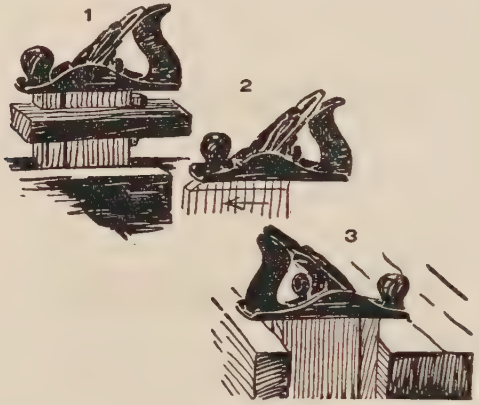


Figure 21

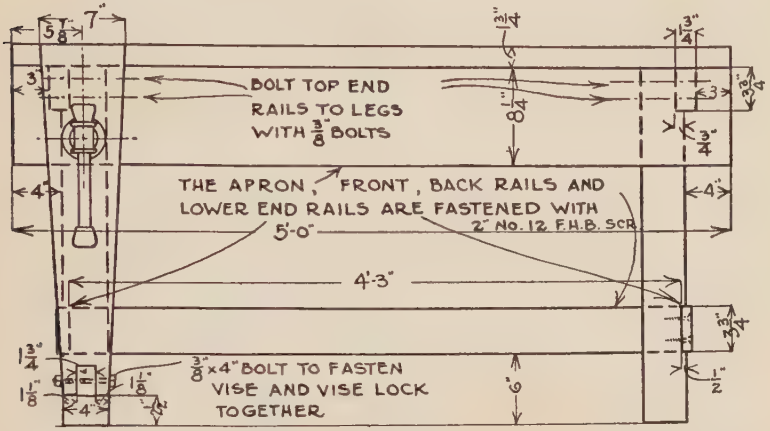
Methods of planing ends without breaking corners.

1. A block clamped to support the last fibers.
2. Corner cut off relieves pressure on last fibers.
3. Hold tightly against work in the vise.

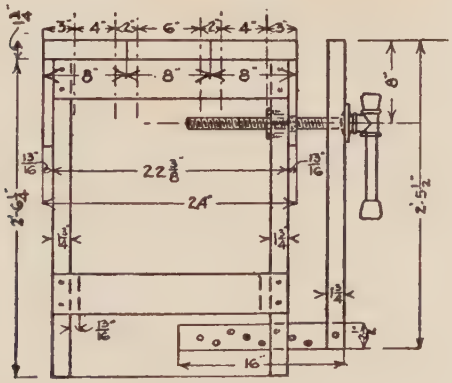
plane, is not far different from actually splitting the piece of wood when you cut over to the far corner.

The procedure is to clamp a piece of wood on the edge of the board which is at the end of your block plane stroke or better, plane from the edges to the center, not making a

through stroke. Sometimes it is necessary to turn the wood in the vise several times rather than to approach the side of the board away from you. Saw as close as you



Front View.



End View.

Figure 22

dare to your mark, leaving only the finest of the finishing to be done at the end with the block plane.

The pieces which, when put together, will comprise your bench are now ready for the next group of operations which

are really joinery. Perhaps it is a good place to mention that the type of bench of the dimensions we have been using as an example has been built many times and that there is a working drawing giving each successive step with accurate dimensions which you can have for the asking. It will come by return mail if you will write to the Stanley Rule & Level Plant, New Britain, Conn., asking for plan No. S–72. On page 45 are two working drawings, the front view and end view from this plan. But before you use that plan you will find it to great advantage to read through the following chapter, as well as this one, for they will aid you not only in the actual use of the tools required, but also in reading the working drawing and in understanding each step of the process.

Back in Chapter III, I suggested an initial set of tools. Here I want to say that you will find the following additional tools very useful:

Hand Rip Saw.
Jack Plane.
Block Plane.
Monkey Wrench.
Countersink.
Expansive Bit.
Combination Oil Stone.
Carriage-Maker's Clamps.
Hand Screws.

CHAPTER V

And Now It Really is a Bench

Anything which is really good and strong must be put together strongly. One way of achieving this is to use binding joints or bolts and screws. The other is to use glue and wooden fasteners. There isn't anything mysterious about glue despite what many carpenters say. But it is easier to use metal hardware. You can more quickly and easily get a strong joint with a bolt and screw properly set than you can with a mortise and tenon, or any of the other joints that cabinetmakers always utilize. So I feel the way to put your bench together is with bolts and screws, utilizing the simplest possible kind of joints, joints which will be strong, even though your hands are not as skilled as they soon will be.

Somehow, there is a satisfaction in tightening up a good strong bolt, pulling together two pieces of wood so that they will stay no matter how much you punish the piece of furniture you are making. A work bench put together with bolts is just as workmanlike as one put together with the most elaborate joints that woodworkers have been able to think of.

In order to put a bench together you need to use only two or three more tools than those which have already been put into service. You will need the saw again; you will need a brace and bits with which to bore holes, a chisel with which to finish up your joints, a screw-driver, and a monkey wrench. This means that there isn't much left to be done. With the various pieces cut to fit I easily finished the job in ten hours, although that includes no finishing touches, such as sandpapering.

Each one of the legs has two cuts of the same kind in it, one cut for the top rail that meets it and one cut for the bottom rail which meets it. In order to make a workmanlike job you want to have these cuts all alike so that the rails will be straight and level with the floor. That was the kind of thing I used to perish over until I saw a carpenter tackling the same kind of a job when he was building some bookcases. Yet it was simple. He took two clamps, such as you can buy for a few cents each, and fastened all four pieces together and marked them simultaneously. How could they help but come out right?

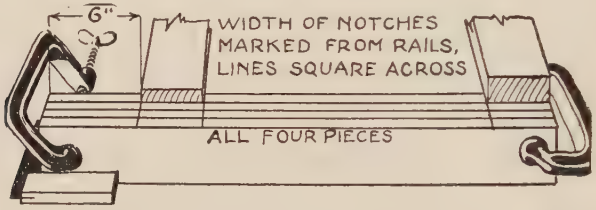


Figure 23

So in this case, by clamping together all four pieces—if you haven't any clamps you can tie them together with heavy cord while you mark them—you can be very sure that the cuts for the joints will be in the right place. All you have to do is to square up the ends together on all four legs, take a bottom rail or stretcher and placing it 6 inches from one end lightly mark both sides with a pencil and square two lines clear across the edges of all four legs. Then take the top rail or stretcher, place it flush with the top of the four legs, make a mark for the bottom of the stretcher, and square a line across the legs. The width of your notches is now marked on all four legs in precisely the right place.

Figure 23 shows in picture form how it is done. You take off the clamps then and make lines square with the edge of each leg, showing the width along the edges of the notch you are going to cut. Then you take the gauge and use it as you did before to mark the depth of the notch—$\frac{3}{4}$ inch for the top rail, $\frac{1}{2}$ inch for the bottom rail. Now your notch is completely scribed or marked out.

Cutting them out is a snap because the grain of the wood will be working with you. You simply saw down carefully on the inside of the lines you have made to the proper depth. It is an aid to make additional saw cuts in the waste wood,

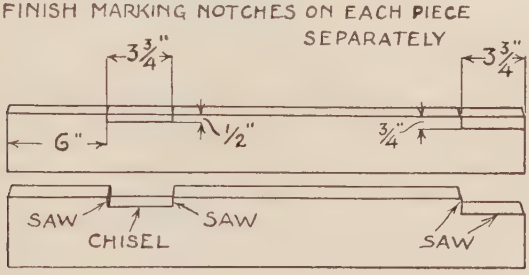


Figure 24

being careful not to go below the lines. This simplifies the chiseling which comes next.

It is with the chisel that the woodworker of all time has made his reputation. It has to be sharp and there's another chapter coming that will tell you how to get it that way.

Fortunately for us the simple joint we are making is easy and there is no effort to be made right here to actually give away all the secrets of the chisel. On the lap joint at the top of each leg, where the top rails or stretchers come in, all you have to do is saw out the waste and then smooth up the bottom of the joint with a chisel. The process is no different from whittling, except that your chisel, because of

the handle, is better equipped for this work than a pocket-knife would be. Do not try to take a large chip and always cut with the grain to prevent splitting. Do not go below the line. If you have done this small task carefully you can try the rail in this joint and it will fit. It will be quite perfect for the purpose of this bench.

This done, the next thing to tackle is the mortise for the vise lock near the foot of the maple leg. I suppose this is the hardest little job for any one to do on this bench. Actually it looks harder than it is. It is really easy,

Figure 25

Test with a try-square or learn to judge by eye.

because we have that marvelous piece of machinery known as the brace and bit.

Holes are bored crooked because the user of the auger doesn't know how simple it is to bore them straight. That's all there is to it. There is no problem involved in boring a hole except to get it straight and not break through the wood on the bottom of the hole.

To bore straight you have only to sight on the piece of wood twice at the beginning and twice more after your hole is fairly well started in the fashion shown in the illustration. One sight shows you whether or not you are holding the bit straight in one plane; the other sight shows you the same thing as to the other plane. This settled you have

nothing to do except to turn the handle and give a reasonable amount of pressure on the head of the brace. What could be sweeter? The tool does the work. You can bore just as fast as you wish to, knowing that for the ordinary hole nothing can go wrong, providing you are doing it carefully, until you get near the bottom of the hole. Then turn the brace slowly, watching or feeling for the point of

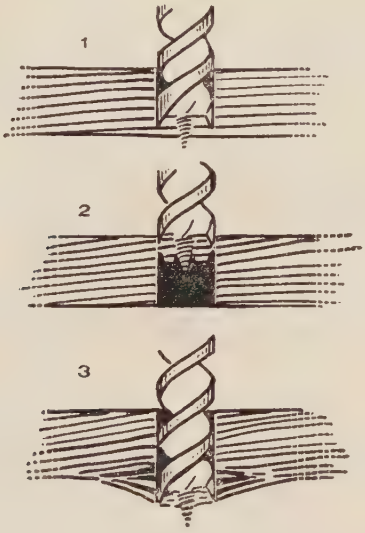


Figure 26

1. Bore until spur appears on the other side.
2. Turn the wood over and finish.
3. Boring through from one side splits the wood.

the bit and as soon as it comes through—stop. Now you bore through from the other side. The result is a clean slick hole where you want it. And this ought to give you something to brag about in your home town, for it is perfectly true that most men who think they are handy around the house universally bore crooked holes, holes that don't come out where they expect them to, holes that ruin the stock upon which they are working.

On the bench we will have to bore holes for the bolts, of course, but we are using the brace and bit for something that an experienced woodworker pointed out to me, that is, we are using the auger to make a square hole. In this case it is the mortise in the maple leg of our bench.

All you have to do is mark out the hole to fit the vise lock, which according to our plan has been made 1¾ inches

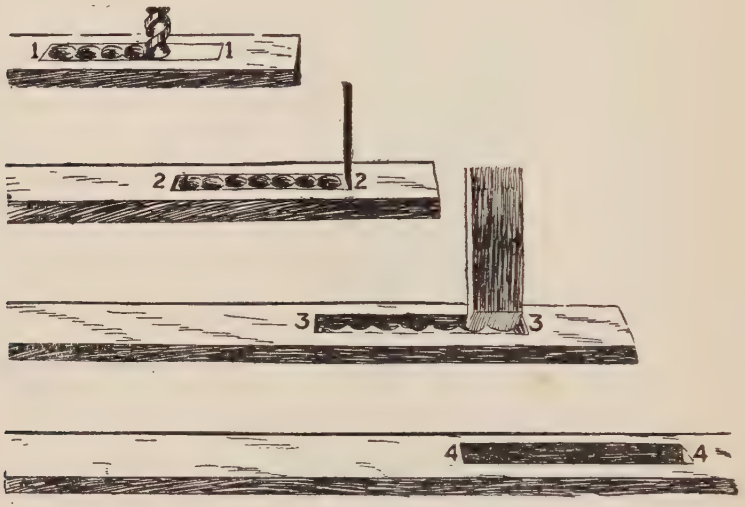


Figure 27

1. Remove waste wood with auger bit.
2. Cut ends with chisel and mallet.
3. Cut sides to line with the chisel.
4. Clean corners and bottom mortise with chisel.

x 2½ inches. That means that the hole must be slightly larger, or 1 13/16 inches x 2 9/16 inches, so that the vise lock will slide back and forth in the mortise easily. When the squared hole has been marked you are ready to make several round holes with your brace and bit—one in each corner and extra holes at top and bottom so that the block of wood you are going to knock out will be weak and easy to remove.

That's the way a square hole is almost always made.

You make one or more round holes with the bit and then you take your chisel and square up those holes. It is rapid and easy. If you have marked your mortise carefully and bored your holes straight the result will surprise you and your whole family with its accuracy. The chisel, if properly sharp, will work beautifully in this piece of maple in the same way that you used it on the lap joints.

Your bench is beginning to shape up. There is only one more joint to make which requires fitting with the wood and that is the notch in the bottom of the vise jaw. This is of exactly the same dimensions as the width and thickness

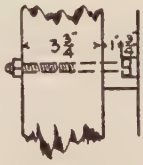


Figure 28

Bolt heads sunk and holes plugged.

of the vise lock you have just made. It is easier to make because it is in the bottom of the vise jaw and therefore has only three sides. The procedure is somewhat the same as for the mortise, except that you can saw out the waste after boring holes near the line in the upper end of the mortise, and chisel to make it smooth and clear.

Now there are some more holes to bore but this time the holes are for screws and bolts—round holes. The holes for the bolts which are used to fasten the rails to the legs and the top boards to the rails are easy because they are just plain holes of the right size for the bolts you are using.

There is this exception—we wish to countersink the heads of the bolts which come through the top. That means that we wish to sink them below the surface and plug up the holes with pieces of wood on top of the bolt heads for

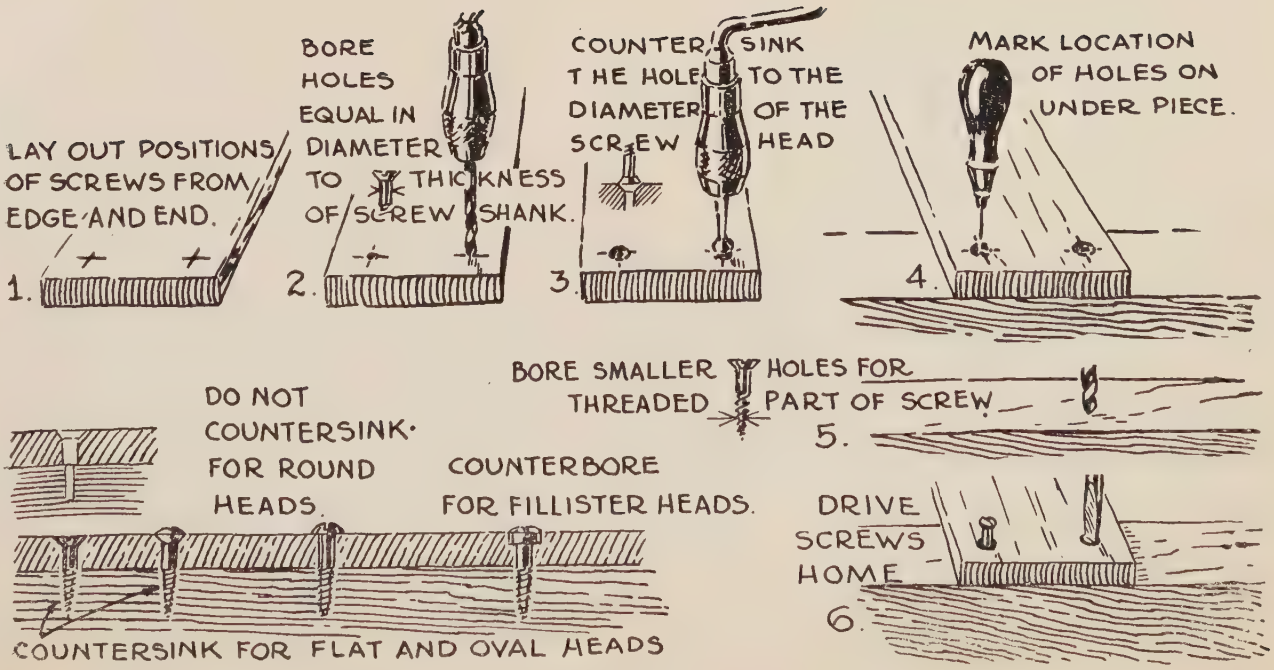

LAY OUT POSITIONS OF SCREWS FROM EDGE AND END.
1.
BORE HOLES EQUAL IN DIAMETER TO THICKNESS OF SCREW SHANK.
2.
COUNTER SINK THE HOLE TO THE DIAMETER OF THE SCREW HEAD
3.
MARK LOCATION OF HOLES ON UNDER PIECE.
4.
BORE SMALLER HOLES FOR THREADED PART OF SCREW
5.
DRIVE SCREWS HOME
6.
DO NOT COUNTERSINK FOR ROUND HEADS.
COUNTERBORE FOR FILLISTER HEADS.
COUNTERSINK FOR FLAT AND OVAL HEADS

Figure 29

the very good reason that we don't want to have our sharp tools striking these bolt heads on top of the bench when we are making a fine bookcase and need to have them as sharp as razors. That means that in those top pieces we first bore a hole slightly larger than the head of the bolt and only $\frac{1}{2}$ inch deep. Then we put in a new bit, just the size of the shank of the bolt itself, and bore clear through.

Remember the big hole must be bored first. If the little hole is bored first it is very difficult to enlarge it afterwards and keep it straight.

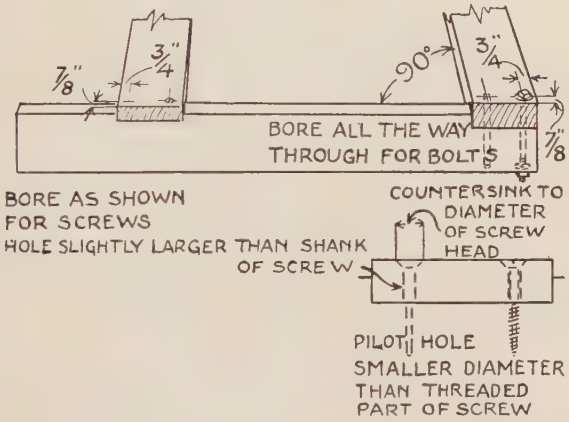


Figure 30

Wherever a screw is to be used, as in the bottom rails and legs, you really need three different bits to do a proper job. The first tool is a bit slightly larger than the smooth shank of the screw. You bore this to the depth of the length of that shank. The second part of the hole is made with a twist bit, a gimlet bit, or a bit like an awl which the shoemaker uses except that it fits into your brace. The awl must be smaller than the threaded part of the screw or the screw won't hold anything. The third bit that you need is a countersink which widens the hole at the top of the board into which the head of the screw fits, so that the

screw is flush with the surface of the top board. Figure 29 shows exactly how this is done.

I never bore all my holes at once because I might have made a mistake somewhere which I could rectify by changing the planned position of the hole to one which is practical and which accommodates my mistake. So when I am putting things together—and I learned this from a carpenter who also occasionally made little mistakes—I bore my holes as I go along.

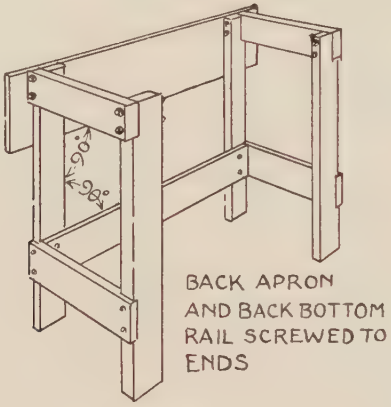


Figure 31

The first step is to take one of the legs and put an end rail on it. The top rail is fastened with bolts; the bottom rail with screws, as shown in the diagram on page 55.

The easiest way to proceed is to fasten together two legs with the end rails; then fasten together two more legs with their end rails; then put on the back bottom rail; then the back apron. Of course you can do this in almost any order you prefer. The method outlined is simply easiest for most people.

The next step is to put on the last bottom rail—the front one; then the front apron. At this point probably nothing can stop you from putting on the top to see what it's going

to look like. Two bolts in each end of each board (be sure and get the maple top piece in front) will hold the top to the bench.

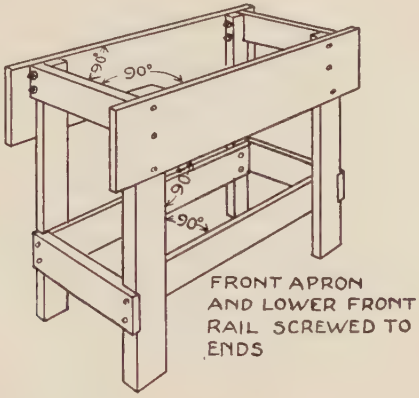


Figure 32

Now you are already to put on the vise. Your job, your first bench, is nearly done. The first thing to do is to make the center line down the maple leg and measure care-

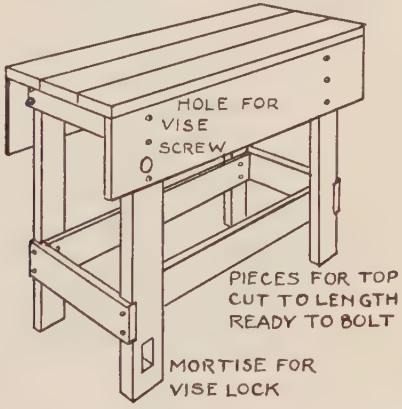


Figure 33

fully the distance between the top of the bench and the center of the hole into which the vise screw is to go, although of course this hole must be bored before you put the top

pieces on. Otherwise it will be very difficult to fasten the vise nut to the inside of the maple leg. When you find the center for this hole there is nothing to do but bore it and

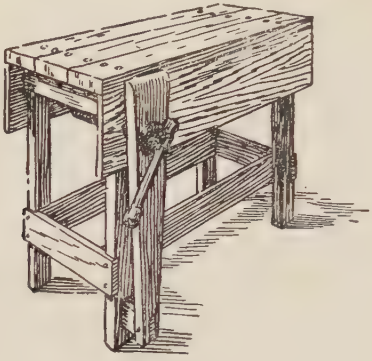


Figure 34

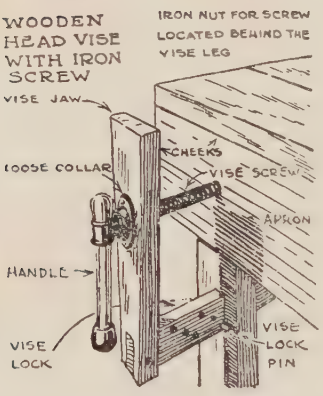


Figure 35

then screw on the female part of the vise screw to the back of the maple leg. The same size hole is bored in the vise jaw; the vise jaw and the vise lock are put together with a bolt and the whole assembled like the sketch shown.

You can bore holes in the vise lock for a wooden pin at any distance apart you choose, as shown in the sketch. Every half inch with the holes staggered is best.

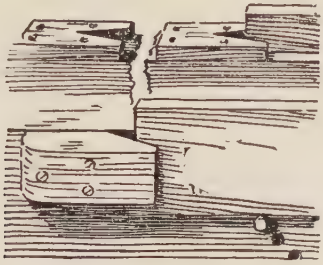


Figure 36

Frog on top of bench.

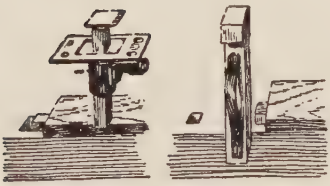


Figure 37

Bench stops.

Figure 37½

Stanley Bench Bracket a handy tool for holding all lengths of boards.

Now, of course, is the right time to bolt the top boards into position. Eureka, your bench is done.

However, you would probably want a frog or a small block of wood in the near left-hand corner to help you in

planing boards on the top of your bench; or you can purchase a bench stop, as illustrated. You can make a frog like the one of which there is a drawing on page 59 and nail or screw it into position on the bench.

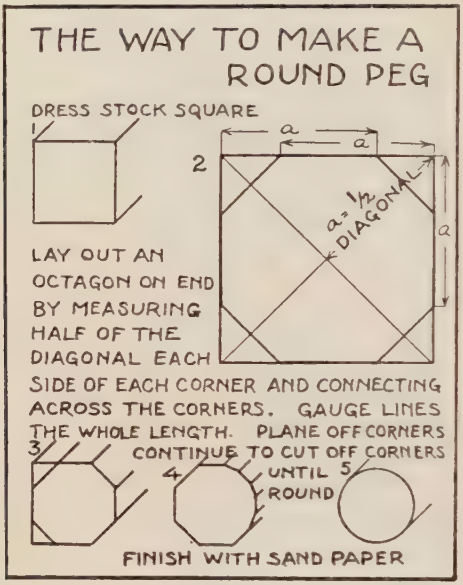


Figure 38

The nails should be set beneath the surface or screws, if used, should be countersunk. You can plug with round pieces of wood the holes into which the bolts of the top have been inserted. You can make little round pegs yourself to drive in and then cut them off flush or you can buy stock already cut of the right size in the form of wooden rods which you can cut to the proper length and drive home on top of the bolts. However, on a nicely finished piece of furniture, plugs are cut with the grain across the

circular end instead of lengthwise, so they will match the grain of work.

Do you find your bench pretty rough? It's perfectly possible it will be even though it was quite a simple thing to make. One of the reasons why, perhaps, is because you have worked, if you have worked from this book, merely from the sketches shown in these chapters. That, of course, isn't the right procedure although it has simplified your whole job. The other reason why it may be a little rough is because of inexperience with tools. You will be surprised at how much more easily the next thing you tackle will go and now that you've gone this far you will never be willing to call in an expensive workman to do little jobs around the house and to make little things for you which you could do just as well yourself and have all the economy and fun of doing it besides.

It would have been more difficult to have followed a working drawing accurately but the job would have been better looking if you had done so. From now on a working drawing to scale will be of great assistance to you in everything you undertake. There is no reason why you shouldn't make your own little drawings and of course for many of the things which you might like to make there are working drawings available just as there is one which you can have for the bench we have been describing. If you will write to The Stanley Rule & Level Plant, New Britain, Conn., you can obtain a list of the working drawings which this company has available and advice on where to obtain others. You won't want very many because after you have worked from other people's working drawings a little bit you will soon be making your own. That's why the next chapter is devoted to facts on working drawings and design. Skip it if you like and go on with the other material in the following chapters which have to do with

the use of other tools than those which have been described and the more expert use of the more important tools which the woodworker finds available.

SHE: *"That's the best combination kitchen stool and step-ladder I've ever seen."*

HE: *"And you didn't think I could do it, did you?"*

CHAPTER VI

Taking It from a Working Drawing

Whatever we decide to make, be it a bookrack, a bookcase, a chest of drawers, or a shelf in the kitchen, we meet the same kind of problems in every case. As a matter of fact, most of the problems of working in wood are met in their simplest forms in making a big, heavy bench, such as has been discussed in a previous chapter. The success of any piece of work is dependent of course on the skill and on the care which has been used in following the design. The final result is, nevertheless, dependent chiefly upon the design and upon the skill with which the various parts of the design have been handled. Obviously if you have a bad drawing to follow your result will be bad, no matter how skillful you are with your joints and your plane surface, no matter how fine the stock you use, no matter how perfectly you have used your hardware.

Some people have a flare for design and automatically produce well constructed ideas which they can then translate into wood, but the truth of the matter is these people are naturally observing of detail. They don't have to think about it. The rest of us have to think about it and if we think about it too there is no reason why we should not become quite passable designers of whatever things we want to make. Moreoever, it is an important fact that if we design ourselves we learn very quickly to take other people's designs from their working drawings with speed and ease. It's a good thing, in other words, to make designs because it enables us the better to use other people's designs. That is not, however, the most important fact. The real fundamental fact behind the importance of mak-

ing your next design is that it's the most fun. There is something magical about conceiving the simplest picture frame, a screen door or a bookrack, making a sketch deciding upon the kinds of joints you are going to use, the kinds of wood, and the fasteners, and then proceeding to translate your creation into something lasting. That is the real source of the woodworker's joy.

The artist must study design from many points of view and it takes him a lifetime. The worker in wood can learn in a few short months by his experience at the bench all that he needs to know to have a great deal of fun. One of the things which he will find out is that every design he makes needs to have balance. That is, in fact, the most important lesson he can possibly learn. A design executed in wood which lacks balance will probably tip over in the slightest breeze, or in carrying the slightest load. A chair needs to have somewhere near an equal amount of weight on each of its four legs. It is this principle which runs not only through useful articles but also through decorative articles. A picture which has all its "weight" on one side as, for instance, a bowl of fruit placed away over to the left, with a broad expanse of table to the right, will always look tipsy and will displease every person who looks at it.

There are other points that are of value in design as you go along—rhythm, tone values, harmony, and contrast. But for the first few years in which we are working in wood what we are really concerned with is strength and stability; balance. The other points may rest with your natural way of seeing things until you find that you want to study wood carving, furniture design, free-hand drawing, and the other fascinating arts which lead out of your interest in woodworking if it continues all your life.

So it is that we can forget "perspective" drawings and deal only with plan drawings. It is enough to know that a

perspective drawing is merely a way of putting on paper what a finished object looks like to the eye from a distance. Plans are just straight diagrams intended to show you the dimensions and actual size and shape of the object you are interested in.

This means that the plan must give you "three dimensional values." That is the technician's involved way of

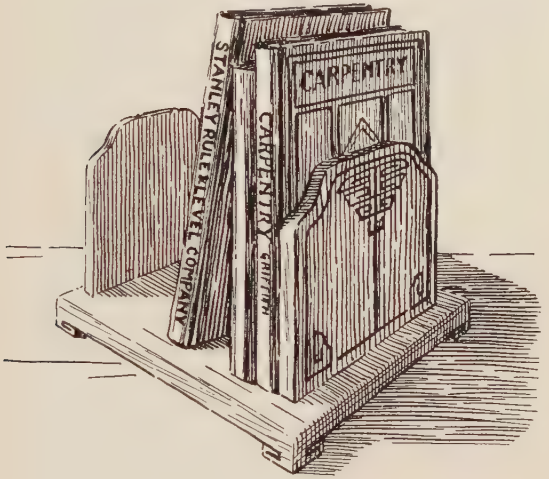


Figure 39

saying that your plan must show thickness, width, and length. It must show you those dimensions for every single stick that goes to make your product; it must show you the size and shape of your mortises, your tenons, and even the hardware which you are going to use.

The result of showing all this in diagrammatic form on a working drawing is that a working drawing, the first time you see one, looks like the scratching of a hen in wet sand. The easiest way to learn how to take anything off a working drawing is to sit down and make one and then to go

on, having made a working drawing, and build the article which you have designed.

It would be a smart trick to make a little bookrack to hold this volume on your new bench, as well as a catalog of tools with the various tables of screw sizes, metric system, weights and measures, board measure, weights, and such things included. For such a purpose the simplest design is by far the most appropriate.

(The design of the bookrack, Figure 39, on a large scale with step by step directions for its making can be obtained from The Stanley Rule & Level Plant, New Britain, Conn. Ask for Stanley Plan No. 1.)

This bookrack has only seven pieces when it is done.

You won't want many books on your bench, so that if your rack is 12 inches over all in length it should indeed be plenty. It will be easy to balance this design because a bookrack has two ends and the flat plate upon which the books sit. It balances automatically because the weight is evenly distributed throughout. It would be a very good thing for you to put feet on it so that the bottom plate will stand up above your bench. Then you can put your fingers under the edge if you want to lift and move the whole thing.

How wide should you make it? The answer is easy. The average book is about 5 inches wide when it is closed. Therefore, if you make it 6 inches wide it will accommodate any books you will want on the bench. Since the bookrack base is to be 12 inches long, making it just half as wide puts it in splendid proportion, the proportion of 12 to 6—that is, 2 to 1. For some reason or other the human eye enjoys simple proportions and by simple proportions is meant those that can be reduced to the relationship of one to two, one to three, two to three, three to four, and a few others. You

know that the proportions of your bookrack will be good because you know in advance that the proportions of one to two are always good.

It is very easy to decide the design of your bottom plate then. Make it 6″ x 12″. If you will draw a rectangle on a piece of paper with these dimensions it will look like this:

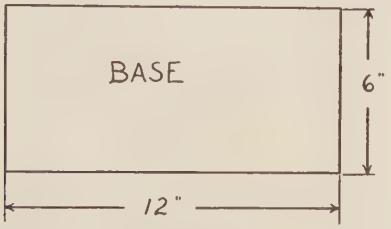


Figure 40

Remembering the sizes in which wood comes—the 1″ thickness, when dressed $\frac{7}{8}$ of an inch,—it will be very convenient and plenty strong enough. Therefore, you have at once the side view of this bottom board. It looks like this:

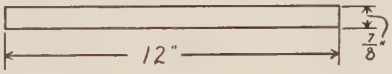


Figure 41

All of my sketches hereafter have been drawn with a rule and inked in so as to make this a nice looking book. It would be much better if you, too, use a rule and draw the sketch but a free-hand drawing will serve your purpose. The book ends themselves should be added to the base. They will be plenty high enough if they are 5 inches above the base. Then as you look at the front view of your bookrack the distance from the top of the book ends to the bottom of the plate will be $5\frac{7}{8}$ inches.

You see those dotted lines at the bottom of the book ends? They show the kind of a joint between the book ends and the base. It is easy to make. It is easy to draw. It will be strong enough to hold your books.

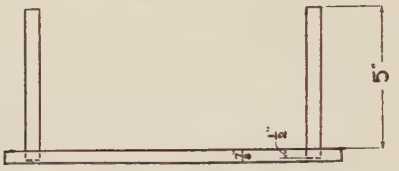


Figure 42

The reason the lines are dotted is because you cannot see the joint if you are looking directly at the bookrack when it is done. It isn't noticeable, but my dotted lines show that both these joints are there.

On the following top view I must show the two book ends. Remember that you are going to look down on the bookrack from straight above. The book ends will become merely lines on top of my drawing like this:

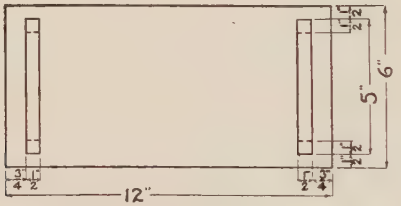


Figure 43

Again you notice some dotted lines. They show the hidden joint between the book ends and the base. They also show that the tenon is made narrower at each end than the book ends. The purpose of this is to have the book end cover up the joint as well as possible so that when the rack

is all done and you are looking at it from any point the joint will be completely concealed.

From this diagram, Figure 43, you will see also that I decided to make the book ends square in dimension because I know that a square is always pleasing. My book ends are 5 inches wide and 5 inches high above the plate. Below is a complete front view of our bookrack.

Did you notice one thing that I haven't spoken of? The edges of the board are rounded. This is one of those fancy touches that one always uses his own judg-

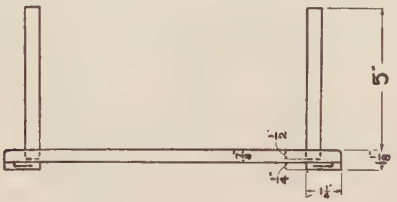


Figure 44

ment about. I like it better this way. Rounded edges can be made with a plane and the use of sandpaper afterward, or with a little cornering tool, Figure 45, that is finger-shaped.

If you like better a plain bevel or chamfer draw that on your sketch.

I have also added feet. They can be plain little blocks of wood. The important thing is that they should not be too tippy, so make them very broad. An inch and a quarter square by one-quarter inch thick would be plenty. Let's add them.

Now you have designed the structure of a bookrack complete with all its dimensions. Any woodworker could take this drawing and produce a duplicate of the bookrack without ever seeing it.

I have not, however, shown what can be done to decorate the ends. It would be fun to take a little saw and a chisel and arch the top. Below are several designs made

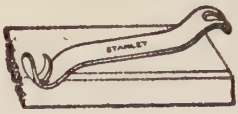


Figure 45

by an artist showing how a skilled workman might do it. These you do not put on your working drawing. You make a separate sketch.

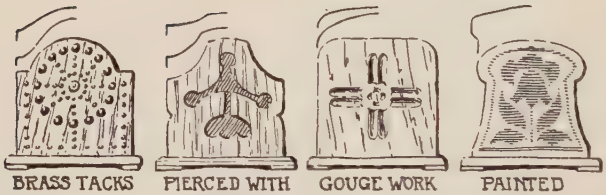


Figure 46

Having drawn this plan yourself it is perfectly obvious that you can work now from the plan to the wood. In other words you can now take it from the working drawing and you can do a better job than you could if you had taken it from your imagination without first making the diagrams.

There is one more part of a working drawing, however, which you may make for your own convenience and that is the layout of stock. Your base is 6 inches wide by 12 inches long when it is finished. You must allow waste wood on each side of your piece. Therefore, you need a

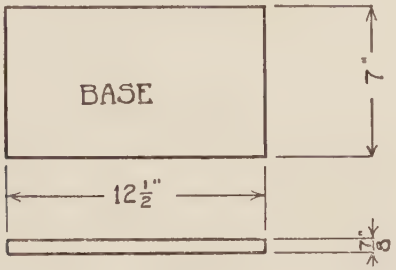


Figure 47

piece at least 12½ inches long by 7 inches wide to allow for your sawing and planing. You can buy lumber which is dressed on both sides and therefor you can figure your final thickness of the base when you purchase your piece of wood. That is to be ⅞ of an inch. The diagram above shows it exactly.

Now you wish to add the two ends and the feet. The two ends are 5½" x 5". Your feet are 1¼ inches square and there must be four of them. You can lay them out like this, allowing waste at each side:

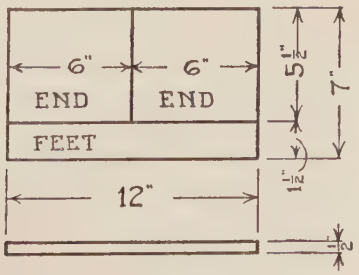


Figure 48

So these are the two boards which you need to make the bookrack. Any kind of wood will do, but it would be most fun to work with mahogany, walnut, oak, cypress, or any other good, clean, clear hard wood.

You are ready now to proceed with your job. You wish to translate your diagram into wood. There it is all waiting for you. And there is very little to do that you have not already done when you made the bench. It must be planed, square, and to size—each and every piece.

You are going to want to drive some brads through the feet into the plate to hold them on. You must make the joints. But outside of that and the use of the glue pot there is absolutely nothing new. It's just like all woodworking. After you've been at it a little while there are only interesting variations using the old motions. That is what makes it so fascinating. Every little thing you do increases your skill. Of course, the operations of finishing are new, too, and so it will be easiest if we go on still talking about the bookrack. We will make the joints, glue the parts together, and take a hand with the sandpaper, ending the job finally with a little shellac, varnish, or linseed oil.

CHAPTER VII

Finishing up the Bookrack

Before you are ready to tackle your joints you have, of course, finished the end pieces and the plate and you are ready to lay out the joint. This mortise is made much the same way as the mortise in the maple leg of the bench in Chapter IV, but it does not go through the base plate. There is only one new problem in the mortise itself. That is the problem of boring the holes. They must be bored only to a certain depth. Some woodworkers use a bit-

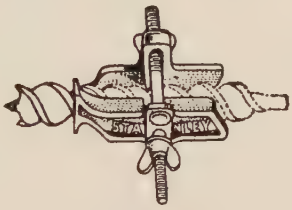


Figure 49

gauge, which is fastened to the bit so that they will not bore too deep and so that all boring will be of the same depth.

A simple contrivance is to bore a hole through a block of wood and then saw the block to the proper length, allowing the bit to protrude the right distance through the hole. When using an auger bit you may regulate the depth of the holes by counting the turns of the bit brace because the screw or spur of an auger bit will pull the bit into wood at a constant rate if the bit is held firmly against the wood. Don't attempt to do it by counting the number of revolutions of the brace if you use a Foerstner bit or a twist bit because the density of the wood may vary and hence the

speed of cutting and depth of cut vary accordingly, even though your pressure is constant on the head of the brace.

There is really one more point about this mortise, a point which applies also to the tenon. It must be done much more accurately and carefully than was necessary in the case of the mortises you made when you built the bench. The way to proceed in laying out joints is to make your measurements with great accuracy and to mark the joints out with a knife point or a very hard pencil, sharpened like a chisel, because careful work cannot be done with thick lines. In cutting joints do not work exactly up to the lines until the final fitting. Make sure which side of the line is the waste wood before cutting. Surfaces in your finished joint should be in contact with each other throughout their entire areas so as to make strong, sightly joints. With reasonable care in both marking and cutting the joints should fit without further trimming.

The tenon is very easy to make because it is merely necessary to make a saw cut at each corner. A chisel will dig out these corners very rapidly and it is easy indeed to make them of the proper size. The mortise itself will be a little bit difficult to make straight on the sides and square in the corners. It is just a question of patient paring with a chisel. Your joint will be much stronger if you do this carefully than it will be if you let the sides or bottom corners be rough.

What is left to be done is the sandpapering and the putting of our five parts together so they will stay.

You have, of course, already done any decorating that you wish to do on the ends of the bookrack itself.

The astonishing thing is that even sandpapering has its little tricks. Not long ago I had a fine piece of moulding completely spoiled by a workman who thought he knew

how to sandpaper—who thought everybody in the world must know how to sandpaper. The same general principle applies to sandpaper as to any other cutting tool. It is easy to sandpaper with the grain. It is not only difficult but almost disastrous to your final finish if you sandpaper across the grain. In such a case you do not smooth your

Figure 50

finished piece but tear and roughen the surface fibers, as shown in the diagram.

The best sandpaper is made of tough prepared paper coated with glue on which is sprinkled particles of graded garnet, quartz, or flint. Garnet or flint paper is the best.

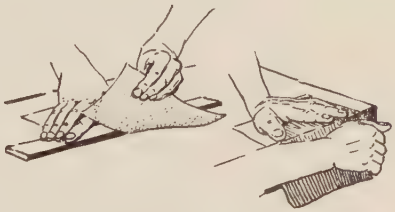


Figure 51

How to tear sandpaper.

Sandpaper runs from very fine No. 5—0 or No. 4—0 to very coarse 5. The diagram shows how to tear it by holding it on the side of a bench.

Another thing that must be watched very closely when you are putting on your fine finish is to avoid rounding

corners. It is just as important to sand an edge squarely as it is to plain it squarely. That's why a square block of wood is important around which to wrap the sandpaper.

Remember, that if you are going to stain the piece your entire job can be spoiled by sanding across the grain. The

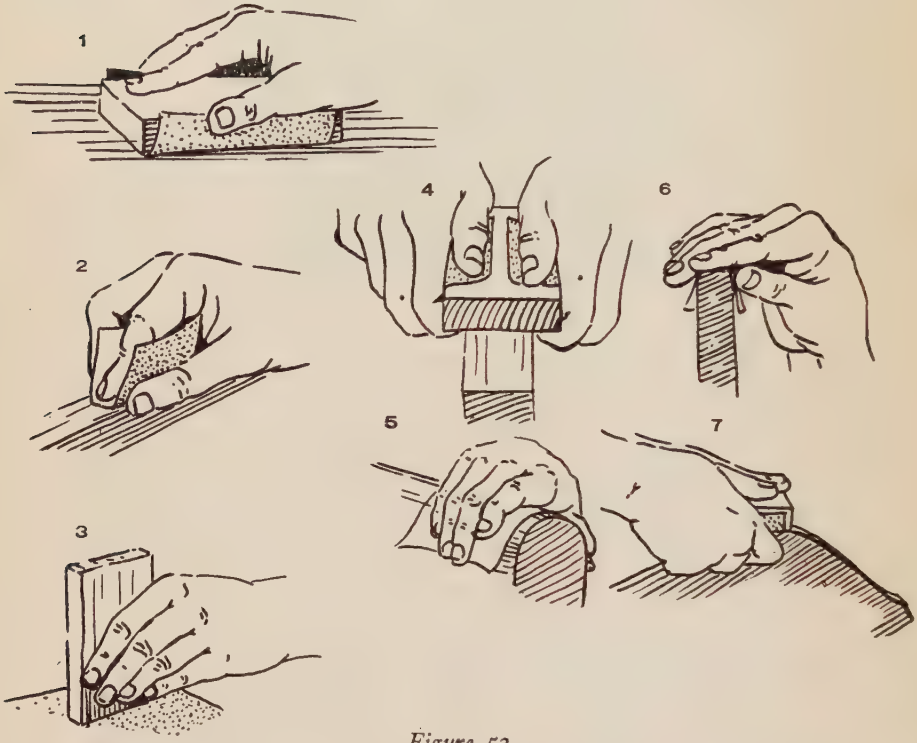


Figure 52

1. To sand a surface.
2. Sanding an edge without a block.
3. To sand the end of a small block.
4. Using a block to keep corners sharp.
5. To sand a rounded edge.
6. Incorrect—Will round corners.
7. To sand a curved surface.

torn fibers of the wood will absorb more of the staining fluid than the rest of the wood, causing dark, unsightly spots and lines.

The pieces should be put together before you stain or finish them. Your next step is to put on the feet.

These feet will have no strain upon them and so it is quite proper, according to the best methods, to nail them on to the plate with brads and yet even such a simple operation has not its points of difficulty but its inherent problems, which can be solved. Many a piece of fine finished oak has been completely ruined by an amateurish or careless workman who drove too large nails through it, thereby splitting the piece as beautifully as though he had done it with an axe. The fact of the matter is that with ordinary nails of fairly good size it is necessary to bore ahead of the nail with a hand drill through a piece of oak as it would be if you were to put in a screw, although of course it must be a tiny hole, not more than two-thirds the size of the shank of the nail itself.

In this case it will insure that you do not split the feet. Even these little brads should be put in carefully and in the right place, not too near the edges and not driven in straight. They should be slanted or toed because they then act as cleats or dovetails and will hold beautifully without any question.

Of course, it is very important that these feet shall be placed squarely on each corner so that they will form an integral part of the finished design as they do in the drawing.

A much better job of putting on the feet will be made if you not only nail them but also glue them although, of course, the gluing must be done before the nailing.

Glue is one of the cabinetmaker's secrets for producing good work. Glue is so strong that when properly used it is frequently much stronger than the wood itself which you have used. Ordinary liquid glue is very convenient because it is always ready at hand for use but it is not as strong as hot glue. No cabinetmaker would think of using anything but glue which has to be "cooked." Freely I

confess, however, that in all my activities in my home workshop I have depended upon liquid glue and found it extremely satisfactory. My efforts have been chiefly put upon getting a thorough coating on the joints which are being made and then firmly fastening these joints together with good clamps and giving the joint plenty of time to dry. I don't ever remember such a joint breaking loose after I was through with it. If you want to use hot glue, full information will be found in Chapter IX. After the glue has hardened and, of course, twenty-four hours should be given it, it is very important to go over the piece of work to remove any surplus exposed glue and to finish with fine sandpaper.

When the gluing is complete you have left only the staining and polishing, one of those little jobs that, with a reasonable amount of care, you can accomplish very quickly and get a good deal of fun out of it. It is a modern idea to finish wood as naturally as possible. You have undoubtedly noticed that things like automobile wheels are nowadays advertised "natural wood finish"; so is the wood used on the bows of the automobile tops. It does not mean, however, that you may leave the wood as it is when you have finished sandpapering.

A well executed piece of woodwork displaying the natural color and sheen of the wood, with its smoothly finished surfaces and tightly fitted joints, has a distinction and charm peculiarly its own.

To the eye of a good workman, no matter how well an article appears, it lacks completion unless something has been done to preserve the beauty of the wood. The beautiful color of a freshly cut piece of wood soon fades, as the action of light, of settling dust, and of dirt from handling, gradually mar the natural beauty. Then again the absorption of moisture and subsequent drying out are detrimental to the wood and to the joints.

Bare wood when washed soon takes on a grayish parched look and the grain becomes rough and splintery. Many woods do not fully show their beautiful color and grain until they have undergone a process of finishing.

There may be many colors in one piece of work, due to the natural variations in the wood or to the use of different kinds of wood for the several parts. In such cases it may be desirable to equalize the different colors. Decide beforehand some arrangement for the colors, whereby a pleasing distribution may be effected.

Finishing a piece of wood serves two purposes, its preservation and the enhancement of its beauty. All work should carry out this idea, but unfortunately in many cases preservation is favored to the exclusion of beauty.

The bookrack may be finished with shellac or varnish, procuring a bright finish. If a dull finish is wished, rub down the varnish or use linseed oil or wax. If you wish to stain the wood a commercial product may be used, preferably an oil stain because it is the easiest one to handle. Apply the stain freely and quickly with sponge, rag, or brush, working with the grain as usual and avoiding carefully any edges which would overlap. As the color begins to dry, rub off with a soft rag any surplus stain not absorbed by the wood. This prevents the grain becoming obscure or clouded. Cover the surface well but do not apply the stain too lavishly.

Shellac is easily applied with a brush and if either shellac or varnish is used it should be rubbed down with very fine sandpaper before a second coat is put on. After a coat of shellac has been applied to seal the pores of the wood ordinary floor wax may be applied to produce a soft dull finish.

And now, with the bookrack completed, you have gone through much more of your apprenticeship in the home

shop than you may realize. If you have not merely read and have actually gone ahead in your shop with the work described you have learned certainly the rudiments of reading a working drawing and you have been through every step of making an article which you have had in mind.

You can go ahead and design various things for use around the house if you like. You are well into a vocation which has no superior, in which there is no limit to the skill you can acquire if you want to acquire it. It is indeed one of the arts if it is carried to the limits of which it is capable. You have to learn only greater skill and the details of more difficult operations. Many of these operations which seem so difficult when you observe the finished product are indeed like those which have already been examined—easy because they are done little by little with care and precision rather than with a slapdash method, careless of detail.

CHAPTER VIII

Sharpening the Tools

One of the biggest satisfactions you can possibly have when you get interested in tools is to take a dull blade and put a good strong edge on it. To possess a tool with an edge sharp enough to shave a hair off the back of your hand —what a thrill that is! You must have felt that kind of a tool.

The other day when the kitchen knife sharpener had been lost and it seemed impossible to get an edge good enough on the blade of the carving knife to slice rare roast beef I had a sudden inspiration. I opened the kitchen window and with a half dozen firm strokes of the blade across the edge of the sandstone window sill just outside I put a keen edge on the knife and proceeded to serve dinner. The window sill was smooth sandstone, just the kind of thing from which was made the stone used by grandfather for grinding his farm tools.

It is only recently that the old-fashioned grindstone made of such materials has gone out of fashion. And the small piece of natural stone which every carpenter of the eighteenth century carried with him for putting an edge on his tools, as well as the large mill-cut circular stone that was turned with a handle or a foot treadle, has gone out of style because we have learned to make stones which serve our purposes better. The little bench stone, driven by a hand crank, which most carpenters now carry with them, is often made of natural emery crushed to varying grades of fineness, mixed, moulded, and baked. Artificial materials made in the electric furnace, like corundum, alundum, and carbide of silicon are crushed, sifted, moulded, and

baked to form stones of every size and shape, of every degree of fineness that is needed.

This is the reason why the old-fashioned natural materials have gone out. The new materials put through manufacturing processes are much better. For the amateur who is enjoying woodworking in his own attic or basement the common oilstone with a rough surface on one side and a fine surface on the other is all that is necessary. If, in the course of time, you find that the edges and bevels of your tools are worn down badly it may become necessary to have them ground so that you can start all over again. Undoubtedly there is some one near you who can do this job, unless when that time comes you wish to do it yourself and to buy or borrow a revolving stone so that you can do your own grinding.

The grinding of edged tools is usually best accomplished on a wet sandstone grindstone because there is no danger of burning or drawing the temper from the steel. If a dry emery stone is used the tool should be frequently dipped in water to keep it cool.

In grinding, the bevel of the tool is placed against the surface of the revolving stone, and held either by hand or clamped in an adjustable guiding device. It is pressed against the wheel which revolves toward the tool.

The tool should be shifted from side to side evenly across the wheel.

The angle of the bevel on chisels and plane blades may vary slightly for soft and hard wood, but for average work an angle of twenty-five degrees will give good results.

An easy way to obtain a good grinding bevel for plane blades is to have the length of the bevel twice the thickness of the blade.

Honing or whetting your edge tools is done much oftener than grinding them. The grinding of your edge tools

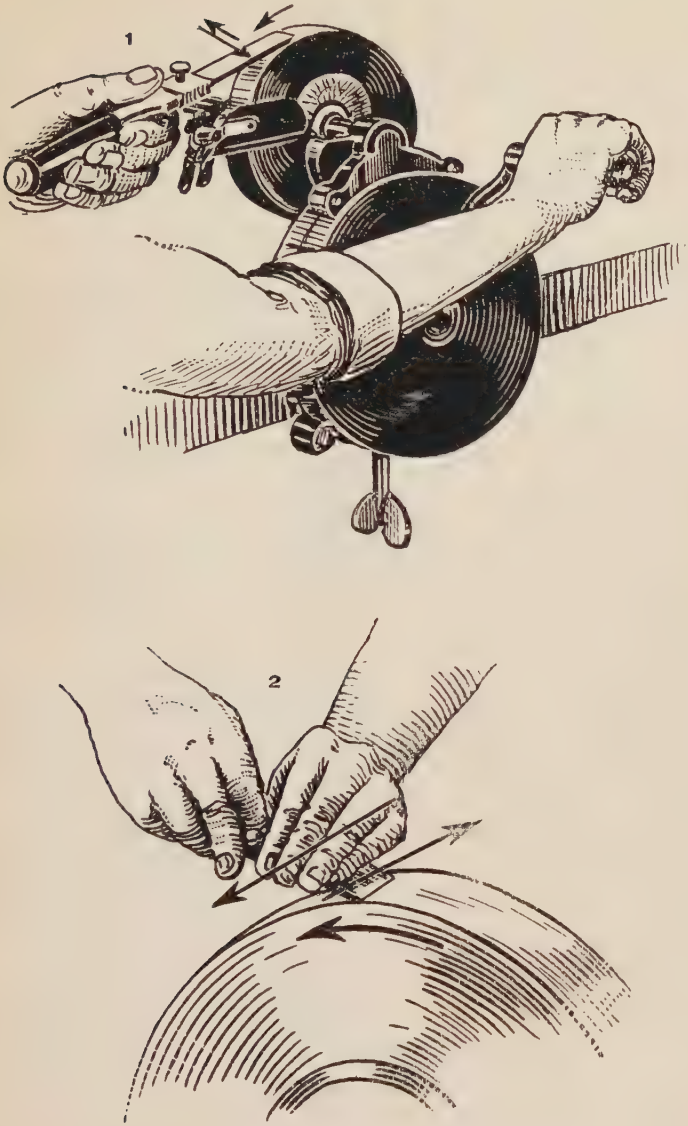


Figure 53

1. Grind toward the edge of tool to reduce burr and wire edge.
2. Press forward and down, over the whole grinding surface, moving the tool back and forth to wear the stone evenly.

should be done only when a new bevel is necessary, or when the edge of the tool is nicked.

Perhaps, more than words, the diagrams on page 85 will tell you the do's and don'ts of honing plane cutters and chisels. A light oil should be used on the stone to float the particles of steel and prevent them from filling the pores of the stone. Kerosene or kerosene and light motor oil mixed do very well. The important fact about chisels and plane cutters is that there are two different angles of the blade. One is the grinding angle, the other the whetting angle. It is only the whetting angle that you will ordinarily attack with an oilstone. In whetting, place the bevel down on the stone with the back edge of bevel slightly raised.

Your sharpening problem is to keep the hand absolutely steady, moving parallel to the stone and in a figure eight to insure the use of the entire surface of the stone and avoid wearing hollows in it. You see, if the surface of this oilstone is not a comparatively perfect plane you can't do much with it. You must have the blade approximately square when you get through with the process. When you have cut this bevel on the oilstone at the proper angle of approximately thirty degrees you will find that there is a wire edge on the back of the blade which must be removed. A stroke or two on the oilstone with the cutting blade held perfectly flat on top of the stone will take this off. A refinement can be given to the edge by stropping it a few times on leather or canvas. Some people like a longer, thinner bevel, about 15° for grinding and 20° for whetting. This is good for light, fine work.

There is a very interesting little tool known as a cutter or chisel grinder for holding the blade you are sharpening at a constant angle. It is a simple little device illustrated on page 86, which takes all the guesswork out and gives you

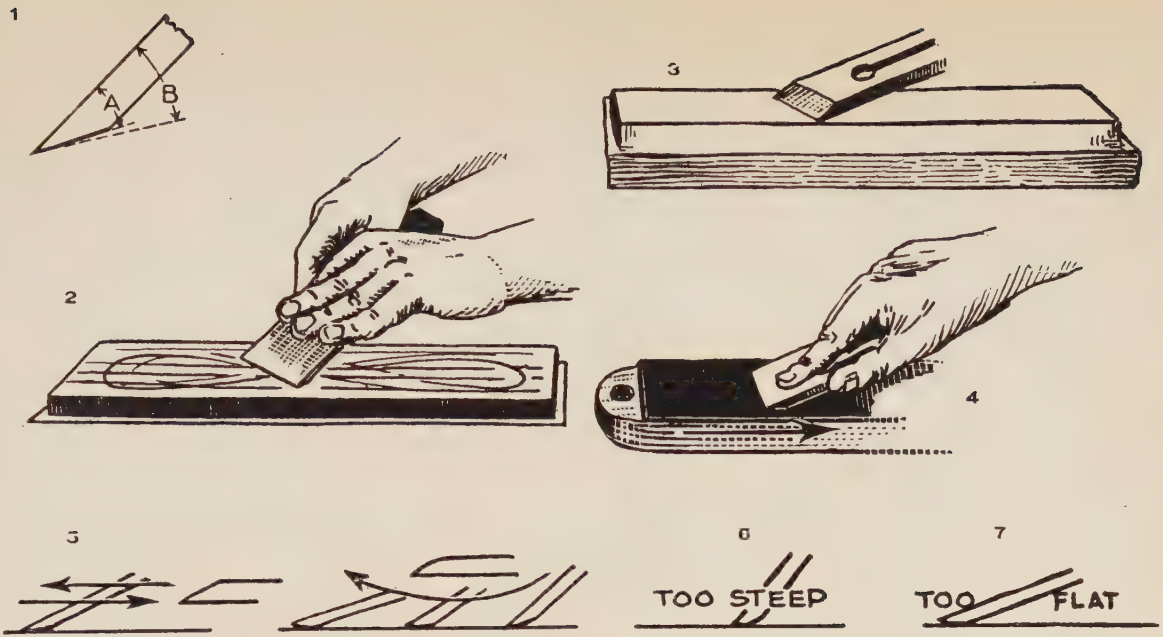


Figure 54

1. Grinding angle "A" from 25° to 30°. Whetting angle "B" 30° to 35°.
2. Whet bevel sideways. Stroke parallel or like a figure eight to wear stone evenly.
3. A few strokes on flat side to remove wire edge.
4. Finish on a strop to produce a keen edge, dragging the blade instead of pushing it.
5. Keep the bevel constant by keeping the hands moving parallel to the stone. Avoid rocking.
6. Edge too blunt to cut well.
7. Edge is not in contact with the stone.

an assurance that no matter how careless you may be or how inexperienced your hand, you can sharpen your tool quite as perfectly as a skilled mechanic could do it.

There is one best way to determine whether or not you have really made a sharp edge and that, strange to say, is by looking at it. A blade which is dull reflects light. A blade which is sharp does not reflect light. So hold your newly sharpened tool where the light will shine upon it and if there are no white spots you can know without

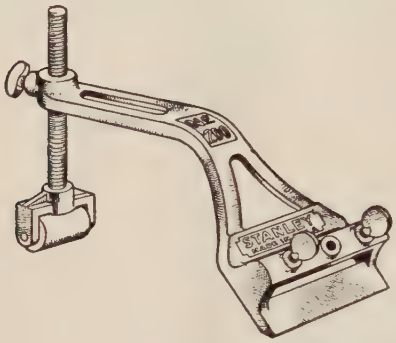


Figure 55

touching it that it is in good condition for even a trying piece of work.

As soon as you are through the stone should be wiped dry.

Grinding and whetting gouges are of course more difficult than sharpening chisels for the reason that they must be done on a curve but the principle is precisely the same for grinding and whetting gouges as in the sharpening of a chisel.

The gouge with the outside bevel is ground as illustrated below, but it is necessary to have a cone-shaped or round edge wheel for grinding the gouge with an inside bevel.

Figure 56

1. Grind the gouge as a chisel, but turn from side to side to keep the shape and to grind all parts of the edge.
2. For the same purpose turn the gouge from side to side as it is pushed forward on the oilstone to whet the edge.
3. Rub the inside edge of an outside ground gouge very lightly to remove wire edge.
4. Sharpen the bevel edge of an inside ground gouge with a round edge oil slip.
5. Round oil edged oil slip.

The illustration above shows how to whet the gouge with the outside bevel and the method employed for gouges with the inside bevel. A slip stone with a round edge is used to remove the wire edge of the gouge with an outside bevel and for whetting the gouge with an inside bevel. The slip stone is held in your hand with care being taken to keep the cutting arc true. It is easy to remove

the wire edge of the gouge with the inside bevel because the unbeveled side can be held flat to the stone but care should be taken to avoid the slightest bevel. The diagrams show better than words how the job is done.

The method is almost the same for sharpening a knife—the diagram shows it beautifully. If the knife is very dull it must be ground first. Remember that this tool is ground

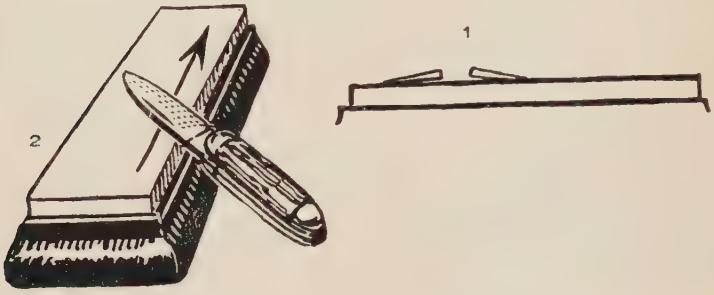


Figure 57

1. Raise the back of the knife blade very slightly while whetting.
2. Rub back and forth on stone, reverse and whet the other side.

on both sides. After grinding lay the side of the blade almost flat on a whetstone and rub it back and forth, that is, both against the blade and with the blade. Repeat this action on the other side. This process is repeated frequently until it is sharp and the wire edge is completely removed. The edge is then finished on a strop.

Blades for iron spokeshaves are sharpened the same as plane blades. Draw knives and the blades of wooden spokeshaves are ground on one face as chisels but held in the hand and whetted with an oilstone or slip.

Axes, hatchets, and adzes are ground on a revolving stone and then held in the hand while a whetstone is rubbed against the edge.

Auger bits are sharpened with an auger bit file and a slip stone. The spurs are sharpened on the inside so as to retain the correct outside diameter. The lips are sharpened on the upper side. The diagram, Figure 59, shows this very well.

Figure 58

The blade of the wooden spokeshave is held in the hand to sharpen the bevel. The edge is whetted with an oil slip. The feather edge on the flat side is removed in the same way. Iron spokeshave blades are sharpened similar to plane blades.

Gimlet bits are not resharpened and, as they are inexpensive, they are discarded when no longer serviceable.

Twist drills are reground by holding them in a special rest against the side of a grinding wheel. The cutting edges should be straight and equal in length and the lips sufficiently cut off to give clearance. The angle between the cutting edges should be fifty-nine degrees. See Figure 60.

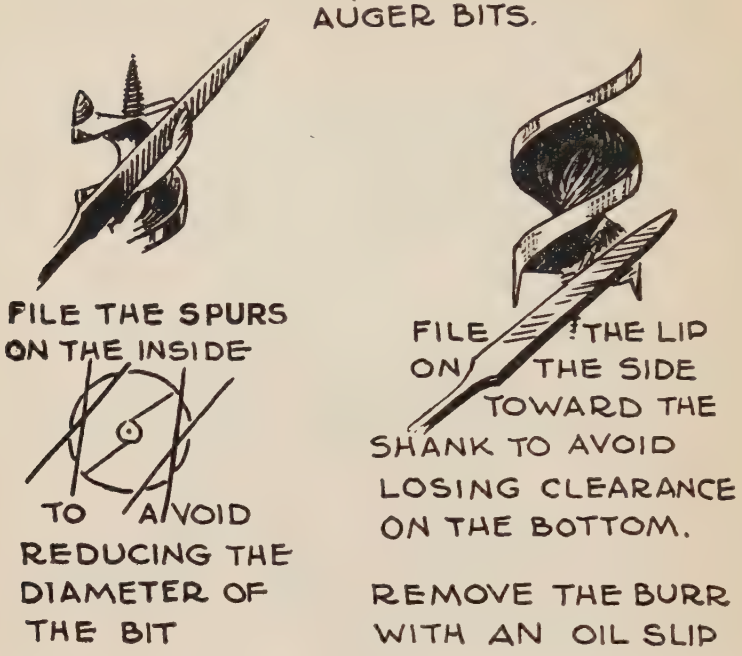


Figure 59

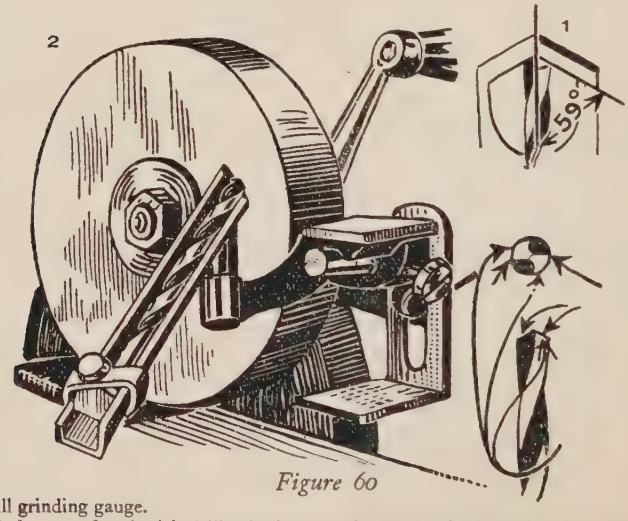


Figure 60

1. Drill grinding gauge.
2. Grinders are fitted with drill grinding attachments to insure grinding straight cutting edges at a proper angle and with sufficient backing or clearance.

The cabinet scraper, perhaps the cheapest tool you possess, is nevertheless one of the finest tools in the cabinetmaker's chest. When you use it for ordinary jobs, such as scraping paint off something, its condition isn't very important but the cabinetmaker uses it as a tool to do the same kind of work that the smoothing plane does but with an even finer shaving. For ordinary use for scraping old woodwork the edge will be keen enough if you file it while it is held upright in a vise or if you grind it down on the side of a wheel. It is most valuable when you want to take the finest possible shaving from a piece of veneer or perhaps from a particular piece of wood that needs only the slightest bit more actual smoothing to bring it up to its true value. The smoothing plane would cut too deeply—so you make a tiny smoothing plane out of your scraper—a real cutting tool. Sharpening it for such work is an extremely interesting operation which is easily understood if you realize that each edge of the scraper is to become a little blade to do its work while you draw the scraper across the wood at approximately seventy degrees.

To sharpen a scraper, grind or file the edge straight and square to the face. In using the file it should be held in both hands and at right angles to the scraper and so moved back and forth. Afterward the scraper should be held upright on a whetstone and the edge rubbed. Then each flat side should be held on the stone and the sides rubbed until the edges are sharp and all trace of any burr removed. The scraper should then be laid face down on the end of the bench and stroked a few times with a burnisher or a small gouge. This will draw out the edge and should be repeated on each side.

Hold the scraper projecting over the edge of the bench with the edge perpendicular and stroke lengthwise with a drawing motion of the burnisher at approximately eighty-

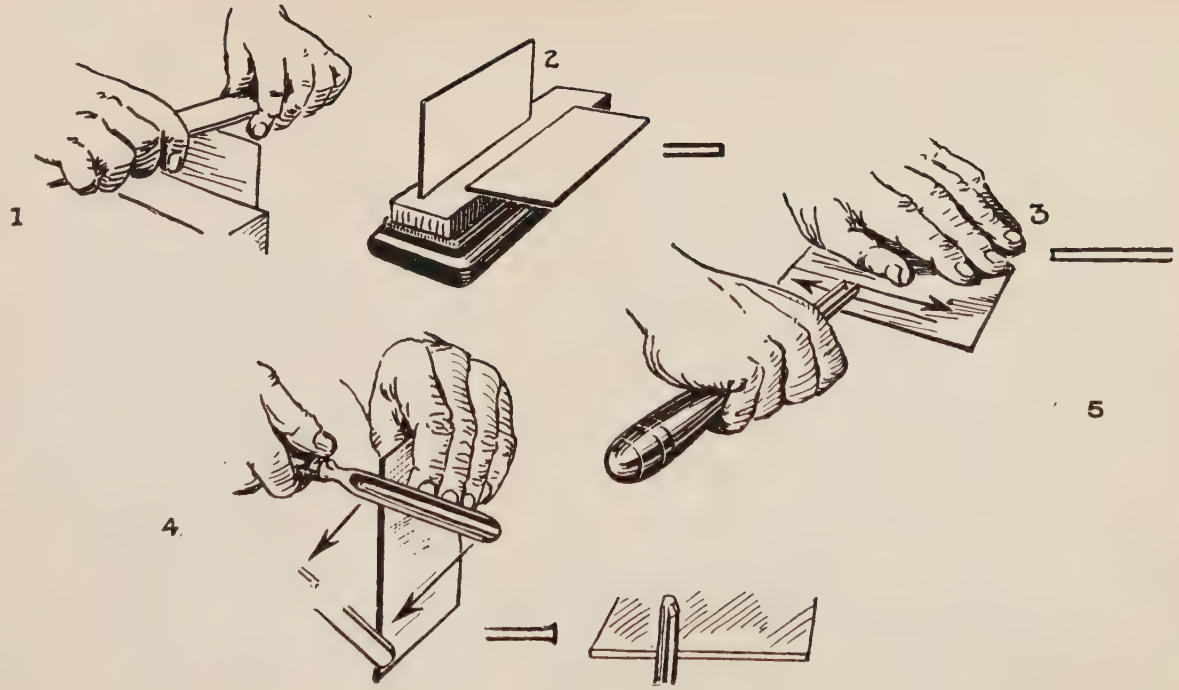


Figure 61

To Sharpen a Scraper.

1. Grind or draw-file the edge square and straight with slightly round corners.
2. Rub the edge and side of the scraper on the oilstone until sharp and free from burr.
3. Stroke a few times with a burnisher or with a gouge used for a burnisher to draw the edge.
4. The edges are turned by holding the scraper as shown and drawing the burnisher in the direction of the arrows.
5. The scraper may also be laid flat on the edge of the bench and the burnisher held perpendicularly to turn edges.

five degrees across the edge. This will turn the edges out. The edges may be renewed several times by the burnisher.

Some scrapers are ground with a bevel and the edge is turned over with the burnisher.

Don't smile when I tell you that one of the most valuable things I ever learned about tools was to use the grindstone on all of my screw-drivers. Properly speaking, of course,

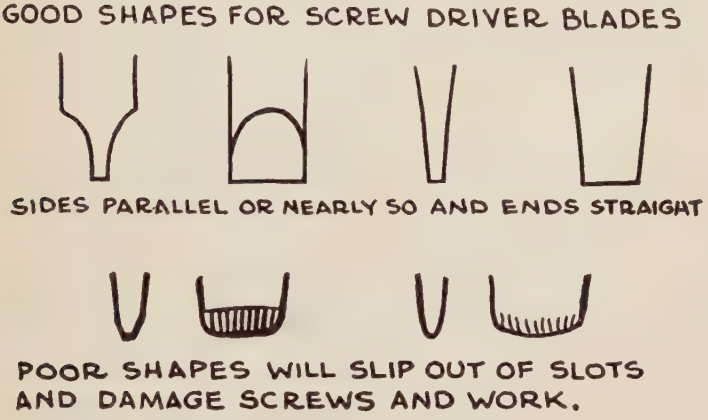


Figure 62

a screw-driver isn't sharpened at all—you need it very dull. Actually you can find more grief with a screw-driver which is improperly formed than any other tool I know. If you look at the poor shapes shown in the diagram you will see pictures of tools I have owned before I knew any better. I always felt like likening them to grasshoppers. Such a tool can jump out of a screw, cut into the piece of fine finished wood you are working with, in fact drive you utterly mad. With a good screw-driver, properly edged, you can easily drive home a screw that fits it and then, if you want to show your strength, you should be able to give it a last twist and

take its head right off, although that is not what you will do when you are finishing a good piece of work. You will stop just short of that difficulty.

Screw-drivers are ground or rubbed on an oilstone to obtain their correct shape. The edge should be made straight across the end and the faces near the ends parallel to each other. This is necessary to keep the screw-driver from slipping.

Filing a saw is really a job for an expert. I have known men who thought they knew how but they would ruin a saw and that is the reason why I don't tackle the job myself. Nevertheless it is a mighty fine thing to know how to do it—otherwise you will discover some day when you are in a hurry that the saw you need to use has been used as a cleaver on a beef bone and you will want to touch it up yourself instead of taking it to a mechanic to have it put in first-class order. This is the reason why the facts about filing the saw with the diagrams shown are being included here. One word of warning ought to be given, however—start your first saw filing experiment on an old saw that you usually keep hanging in the woodshed and not on your finely geared-up 22-inch crosscut. In saw filing practice counts.

The saw should first be placed in a saw clamp and the points evened with a flat file or a hand saw jointer.

Then set the teeth by bending each alternate tooth to the right or to the left so as to secure clearance for the blade when cutting. Set every other tooth on one side first and then on the other side.

The really best way is to use the tool made for this work, a saw set. See Figure 63.

The shape of the body and handle of this tool enables the user to operate it with ease. The saw is held firmly against the gauge while the tooth is being set. The saw teeth are in

plain view, which enables the user to quickly adjust the tool to the tooth to be set. The average set for a saw would require the anvil to be so adjusted that the lower line of the bevel be placed about one-third the height of the tooth from the point. It should never be lower than half the height of the tooth, as this may cause the blade to spring or crack and is liable to break out a tooth.

Another method of setting the teeth of a saw is by the use of a hammer and a special anvil, giving each tooth a sharp blow. This method, however, requires much skill.

Figure 63

The set of a saw varies according to the work, soft, wet wood requiring more set than dry hard woods.

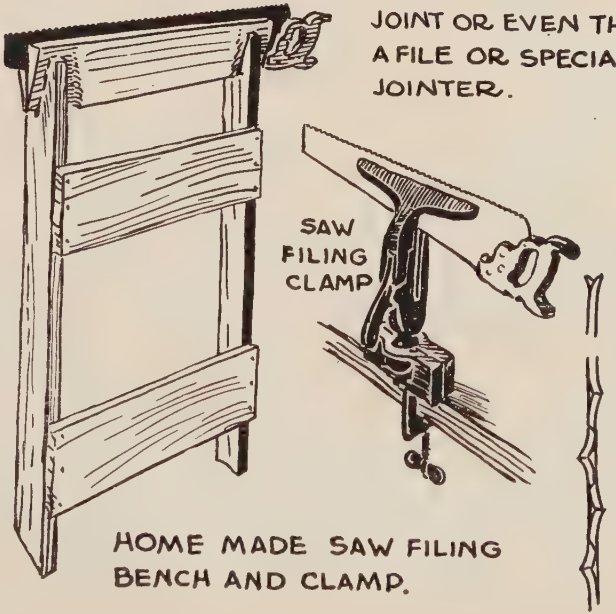
The saw is next ready for sharpening by filing the teeth with a three-sided blunt or taper file.

The workman takes his position at the left of the clamp and at the point of the saw.

For crosscut saws, the file is held at an angle of forty-five degrees and allowed to drop into the gullet between the first and second tooth. This position of the file determines the location for each succeeding stroke. Each alternate tooth is filed, working from the point to the handle, filing against the front edges of the teeth. The saw is then

HOLD THE SAW IN A SAW CLAMP FOR THE FIRST STEP IN SHARPENING.

JOINT OR EVEN THE POINTS WITH A FILE OR SPECIAL HAND SAW JOINTER.



HOME MADE SAW FILING BENCH AND CLAMP.

THE SECOND STEP IS TO SET OR SLIGHTLY BEND OUT EVERY OTHER TOOTH TO SECURE CLEARANCE FOR BLADE WHEN CUTTING.

Figure 64

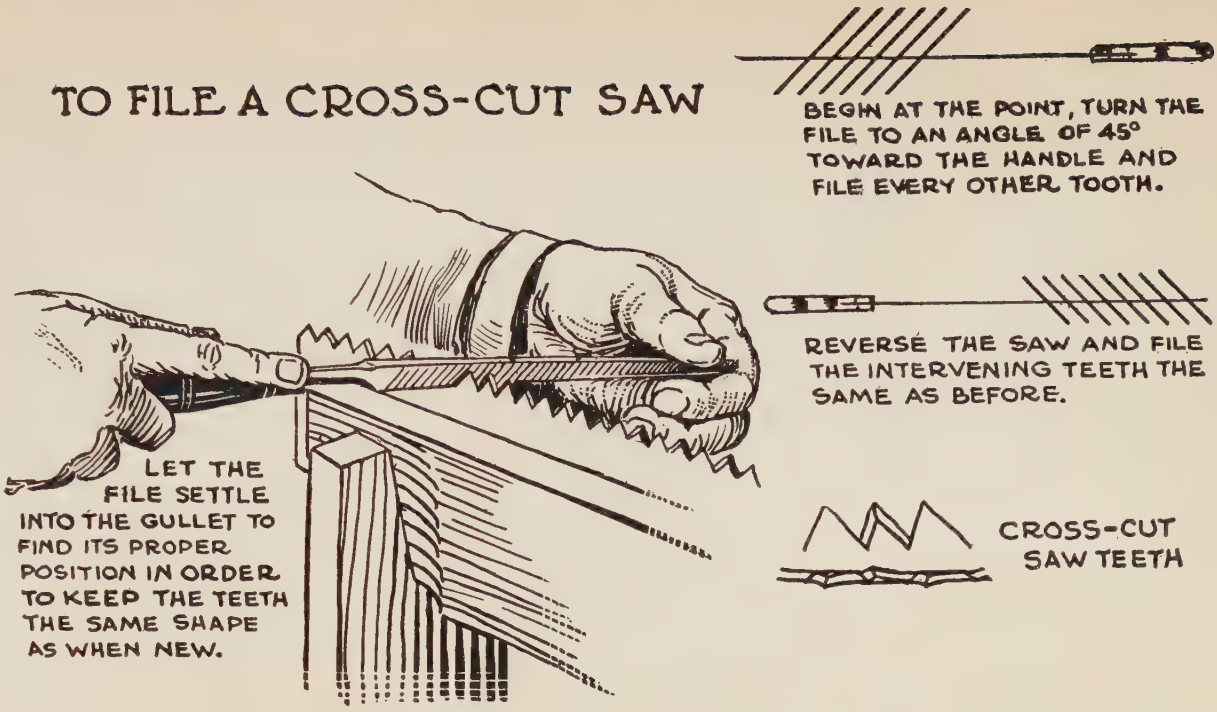

TO FILE A CROSS-CUT SAW
BEGIN AT THE POINT, TURN THE FILE TO AN ANGLE OF 45° TOWARD THE HANDLE AND FILE EVERY OTHER TOOTH.
REVERSE THE SAW AND FILE THE INTERVENING TEETH THE SAME AS BEFORE.
CROSS-CUT SAW TEETH
LET THE FILE SETTLE INTO THE GULLET TO FIND ITS PROPER POSITION IN ORDER TO KEEP THE TEETH THE SAME SHAPE AS WHEN NEW.

Figure 65

turned around and the workman changes his position to the right side of the clamp. The remaining teeth are then filed in the same way.

After the teeth have all been filed, the saw is laid flat on the bench. A file or an oilstone is gently slipped over the sides of the teeth to correct any slight differences in the set and also to remove any wire edge.

Some expert saw filers claim that the saw should be filed from the handle toward the point, contending that the file can more readily find its position in the gullet and that the

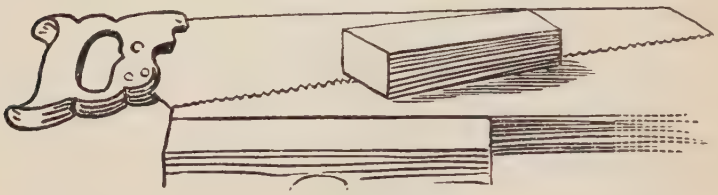


Figure 65½

The sides of the teeth should be very lightly dressed with a file or oilstone after filing to even the set and to remove any burr or wire edge from filing.

original angle and shape of the teeth can be more easily retained. Working in this way, the file is sharpening the front edge of the tooth, that is, set away from the operator and is cutting as it moves away from the edge. This has a tendency to produce a wire edge. By the other method the file cuts as it moves toward the edge of the tooth bringing it up keen and clean. This holds true when grinding a chisel or knife, less wire edge being made when the stone revolves toward the tool edge.

A ripsaw is jointed and set in the same manner as the crosscut saw. The file is held at right angles to the blade and when each alternate tooth has been filed, the saw is reversed and the intervening teeth sharpened.

There is apt to be a slight inequality of pressure during a file stroke, which would cause the saw to run off the line if all the teeth were filed from one side. This is equalized by filing alternate teeth from opposite side.

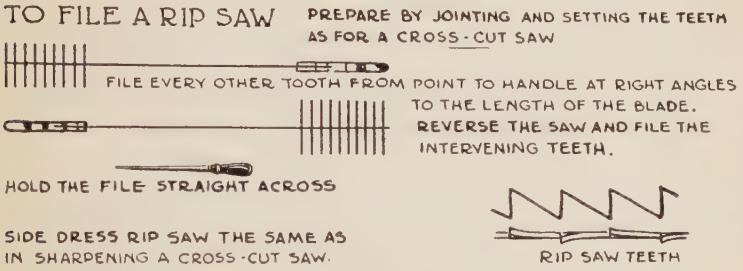


Figure 65¾

Some ripsaws, although filed perfectly square on the front of the teeth, have a slight slant on the top or back edge, due to holding the handle of the file lower than the point. Here, of course, it is obvious that the teeth must be filed alternately from opposite sides.

CHAPTER IX

More about Putting Pieces Together

Of course it is perfectly true that most amateurs never expect to get very much beyond the place where they are using a plane, a saw, a screw-driver, and a hammer with reasonable skill. But if you will follow through in the shop the various little processes which have been described on previous pages you will undoubtedly find that your skill is greater than you supposed. You have already stepped beyond the ordinary householder and into the department of joinery. The moment you put two pieces together—jointed two members—you have stepped into this department although, of course, in its proper meaning joinery refers to the inside work of constructing and installing the fittings of a house.

No one would dignify the nailing together of a couple of members with the term joinery. Nor would a craftsman regard even the joining of members with bolts and screws as well within the department. But the moment you make a mortise or a mitre you are doing the kind of work that the joiner regards as peculiarly his. The cabinetmaker into whose department you venture as soon as you make the simple bookrack, or the most elaborate inlaid writing desk, is first of all a joiner who always puts together the members upon which he is working with fitted joints and hot glue. He even objects, as an artist, to using screws which will be hidden away. He uses dowels of wood. The strength of his joints depends upon the type he chooses and the quality of the fitting. The carpenter working with rough materials achieves strength by using large pieces and by the

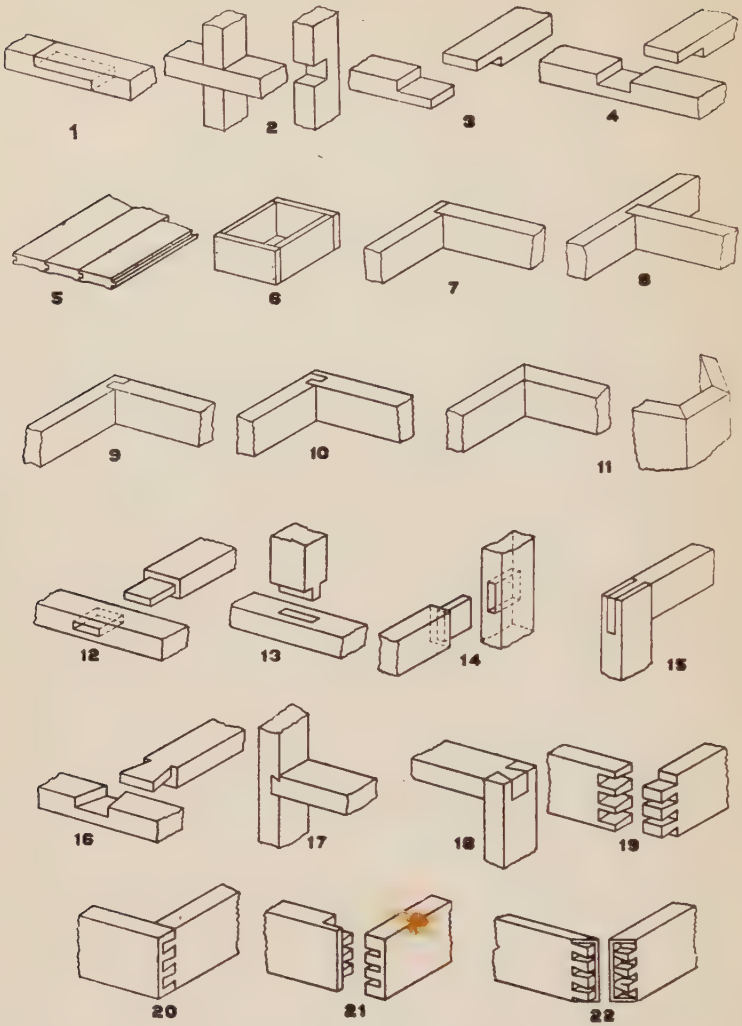


Figure 66

This illustrates the common joints.

1. Half Lap Joint.
2. Cross Lap Joint.
3. End Lap Joint.
4. Middle Lap Joint.
5. Tongue Groove Joint.
6. Butt Joint.
7. Rabbet Joint.
8 Dado Joint.
9. Dado and Rabbet Joint.
10. Dado Tongue and Rabbet Joint.
11. Mitre Joint.
12. Through Mortise Tenon.
13. Stub Mortise Tenon.
14. Blind Mortise Tenon.
15. Open Mortise Tenon.
16. Lap Dovetail.
17. Dovetail Dado.
18. Through Single Dovetail.
19. Through Multiple Dovetail.
20. Lap Dovetail or Half Blind Dovetail.
21. Stopped Lap Dovetail.
22. Blind Mitre or Secret Dovetail.

position in which he puts those pieces. Men have been working so long with wood that they have, of course, invented innumerable joints. But the fact of the matter is that each joint which you might attempt to make is nothing more nor less than a further adventure with the plane, the saw, and the chisel. The simpler the joint, as in the stub tenon and mortise used on the bookrack in the preceding chapter, the less cutting and fitting there is to be done. That is the reason why some joints are easier to make than others and that is one reason why the simpler joints are chosen for simple structures.

If you were to decide to make a set of screens for your house it would be poor judgment, from the joiner's point of view, to put together the stiles and rails with elaborate dovetail joining, although such a joint might be perfectly good after you had worked it out on the various members. Obviously your choice for such work should be the simplest strong one you could think of. An end lap joint would join the top and bottom rails. The center rail could be fastened to the stiles with a middle lap joint. A full length screen can be made thus with six joints, one for each end of the three horizontal members. Of course, such simple joints require fasteners. They do not fasten themselves, as do the more elaborate joints which are to be described here. The fact is that you can make very acceptable screens by fastening these joints with eight-penny nails although screws would give you a better job.

You can also make such a thing as a drawer without using any elaborate joints at all, although the best drawer construction requires, without a doubt, the dovetailing of the front board on which so much strain comes when you are opening the drawer. Again for putting together the four sides of the drawer you could use a plain rabbet joint nailed instead of the elaborate dovetail.

The moment, however, you want to make a drawer, which is a real drawer, you are faced with the necessity of making a dovetail corner. You can use dowel pins to hold the two ends of the drawer to the front board, which will give you a workmanlike joint. It will be quite strong and much easier to make than the dovetail. It requires only the usual careful fitting of this simple joint and the insertion of three or four dowel pins. Glue, of course, should also be used in putting this joint together.

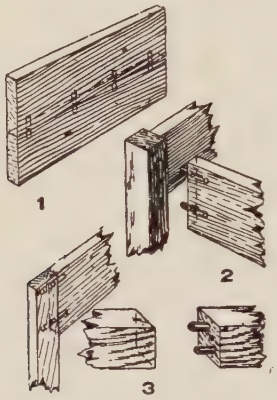


Figure 67

1. Dowels used to strengthen long jointed edges.
2. As a substitute for mortises and tenons in the legs and rails of chairs and tables.
3. To join stiles and rails in frames and where ends are squarely butted together.

As a matter of fact the dowel pin method, which is much stronger than nailing and much more acceptable in all furniture than either nailing or screwing, is easy to make. Above is illustrated how dowels are often used.

Dowels are round wooden pegs cut a trifle shorter than the sum of the depth of each of the two holes into which they are set. Each of the dowel pins is slightly chamfered with a knife or dowel sharpener to prevent binding when they are forced into place. Usually also there is a little V-groove cut in a dowel pin with a knife the entire length of

the peg to permit the escape of excessive glue and imprisoned air when the dowel is driven in. Such a little groove prevents splitting the piece upon which you are working.

Dowels can be purchased at any hardware store. They are usually made of maple or birch and come in various diameters from $\frac{1}{4}$ inch to $\frac{3}{4}$ inch in any length desired.

To prove the accuracy of the location and boring of dowel holes the work should be clamped together without glue for a trial. If the dowel holes are not in alignment, a

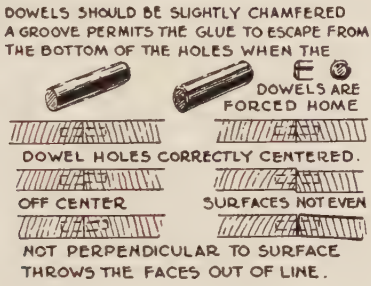


Figure 68

dowel should be glued into one or both; you then cut off flush and rebore.

To make a dowel butt joint, as illustrated on the upper end of the left sketch of Figure 69, proceed as follows: Gauge a line on one piece in the center of the end, parallel to the face and a little way down each edge so that it may be located when covered up.

A line is then gauged parallel to the edge on both faces of the second piece. A hand screw is clamped to the first piece with its side even with the end. This in turn is clamped to the second piece, with the ends of the line on the first piece, matching the line on one face of the second. Dots are placed on the line on the outside face of the second piece to mark the centers of the dowel holes. The auger bit

is then centered on these dots and each hole is bored in both pieces of wood and if they are carefully clamped together the holes will match.

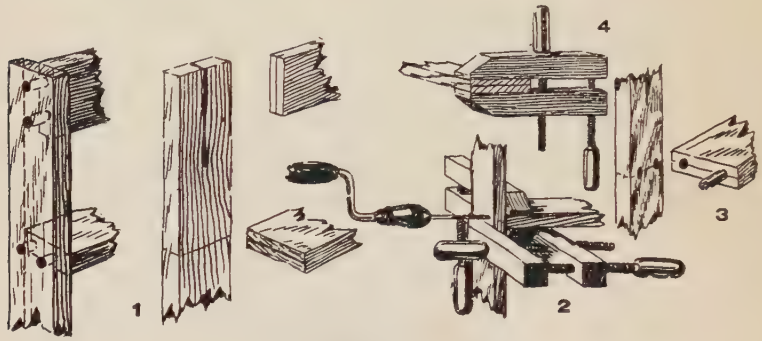


Figure 69

Doweled butt joints.

1. Pieces marked so that they may be clamped together and dowel holes correctly centered, bored in both at one time.
2. Boring dowel holes.
3. Holes bored ready to glue.
4. Method of clamping together while boring.

For the dowel butt joint in the lower left sketch of Figure 69, a line is squared on the edge of the second piece, squared across both faces and the opposite edge. This will give you the guide lines for this joint. Clamping with hand screws and the boring of holes are the same as above. Often it is not desirable to have dowels come through either for appearance sake or because the wood is too thick.

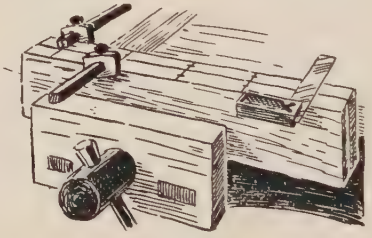


Figure 70

Centers for dowel holes may be marked by placing two pieces of wood together, edges even, work face out. Square lines across both pieces the required distance from the ends. Set the gauge in order to locate the crossing lines, showing the distance of the holes from the edges.

Blind dowel holes may be laid out in several ways. The two pieces may be clamped together with the butting surfaces flush with each other. Lines are then squared across both surfaces at the same time, showing the location of the dowels. They may then be taken apart and gauge marks made from the "work faces," crossing the squared lines, thus locating the centers of the dowel holes.

Another way is to gauge a line in the center of the end of one piece parallel to the "work face." Then square lines across the end, square to the "work face," the correct

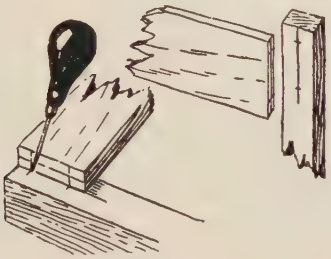


Figure 71

Centers for dowel holes may be located by marking them on end of the rail with gauge and square, then on the legs, gauging the distance from the edge with the rail held in place and matching this line. The centers are marked off on the line on the leg.

distance from the "work edge." Where these lines cross are the centers for the dowel holes. A line is squared or gauged on the second piece to correspond to the center line gauged on the end of the first piece. The arris (corner) of the first piece is matched to this line with the first piece held the correct distance from the end. The location of the squared lines is then transferred to the line on the second piece with an awl, knife, or sharp pencil.

If many pieces are to be marked alike, it will save time and result in more accurate work if a wood or metal template (pattern or guide) or marker is made.

After setting out the centers for the holes, they should be carefully bored with an auger bit square to the surface of

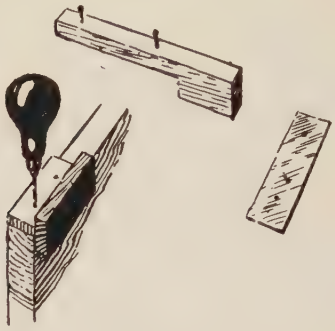


Figure 72

Where many dowel holes are to be marked, similarly spaced, it may be done with nails driven into a block or with an awl through holes in wooden or metal templates.

the wood. A bit gauge may be used to regulate the depth of the holes.

There is a tool, the doweling jig, designed especially for this work. It enables the user to bore dowel holes in the edge end or surface of work with ease and accuracy. It will

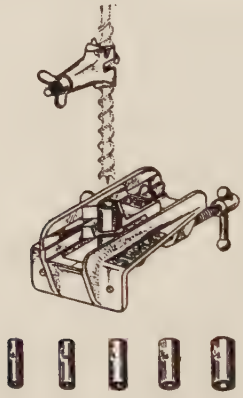


Figure 73

take any thickness of material up to three inches. It is an excellent bit guide for mortising.

The pieces are clamped together and the lines squared across the edges or ends as the case may be. The instructions with the following illustrations show clearly how this tool is operated:

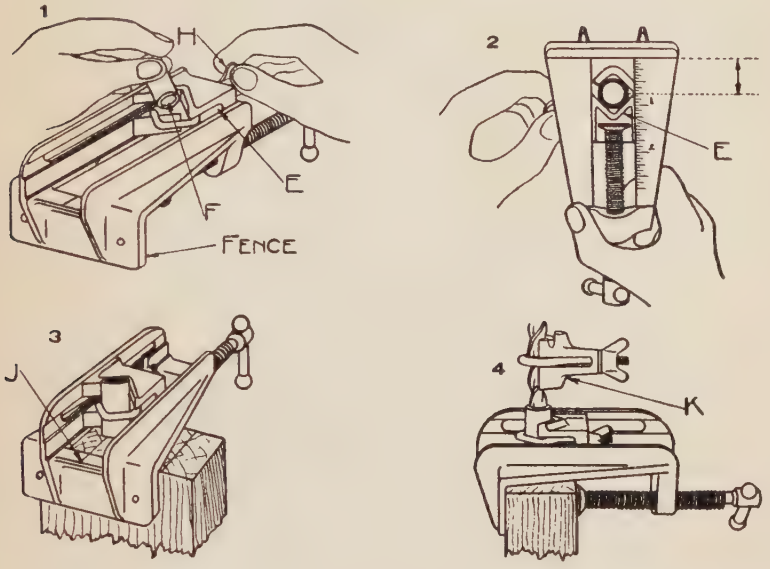


Figure 74

1. Select the proper size dowel and the same size guide "F." Place the guide in the slide "E" with the two marks on the guide downward and parallel to the fence and fasten securely with thumb nut "H."
2. Adjust the slide "E" so that the marks on the guide will be at the proper graduation to bring the center of the hole the distance desired from the face side of the stock.
3. Place the doweling jig on one of the pieces of stock with the fence next to the face side. Bring the mark "J" even with the squared line on the edge of stock. Clamp securely.
4. Place the bit of proper size into the guide, using care not to strike the cutting edge of the bit against the steel guide. Bore for each hole. If it is desired to bore to a given depth, place the depth gauge "K" in the proper position on the bit.

The cylinder locates the hole the correct distance from the face and guides the bit perpendicularly to the surface. The bit gauge furnished with the jig regulates the depth of the holes.

Another joint which you might have used in making your screens is one of the very commonest that there is—the

mitre. You use it on door frames, always on picture frames, and even on pieces of furniture.

Mitre joints are butt joints with the angle at the corner halved between the two pieces. The mitre is cut at an angle of forty-five degrees, that is, half a right angle.

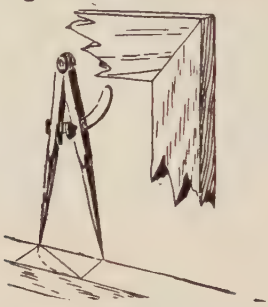


Figure 75

Mitre joints may be laid out by construction measuring and squaring lines as far apart as the wood is wide and joining the points of intersection with the edges on opposite sides.

A forty-five degree mitre may be laid out by squaring a line across the face of the wood, then measuring along one edge, a point equal to the width of the wood, and connecting this point with the other end of the squared line.

Mitre joints are usually sawed in a mitre box. Below is an illustration of a homemade box.

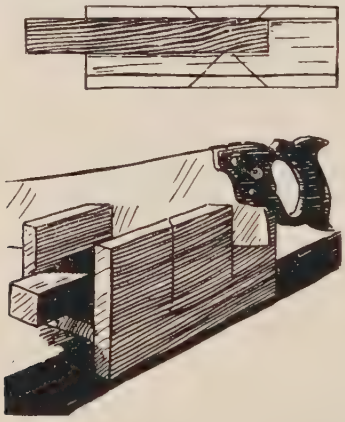


Figure 76
A homemade mitre box.

Mitre boxes similar to the Stanley mitre box can do this work to much better advantage.

Steel mitre boxes are accurate machines for cutting wood to any angle from thirty to ninety degrees.

They have many unique features, including catches with automatic release for holding the saw above the work, and releasing when ready to cut, a length stop for duplicating pieces of a given length.

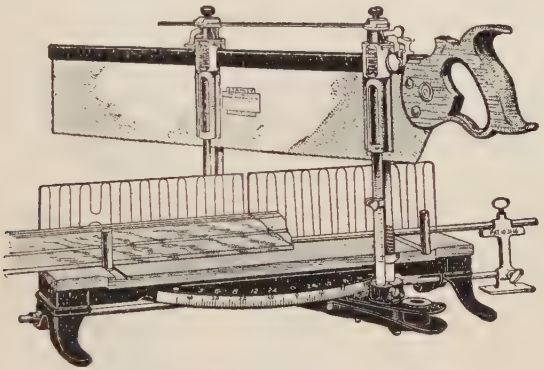


Figure 77

The quadrant is graduated in degrees and numbered for cutting 3, 4, 5, 6, 8, 12 and 24 sided figures. The illustration above shows a large complete mitre box. There are smaller boxes which are accurate and less expensive.

Mitre joints are usually nailed, or nailed and glued together. When nailed and glued together a picture frame vise is generally used or some other special clamp. They may be strengthened with dowels, tongues or slip feathers, which are sometimes used.

Doweled mitre joints are doweled the same as butt joints.

In tongued mitre joints each piece is grooved, and a tongue or spline is glued in, giving greater strength through

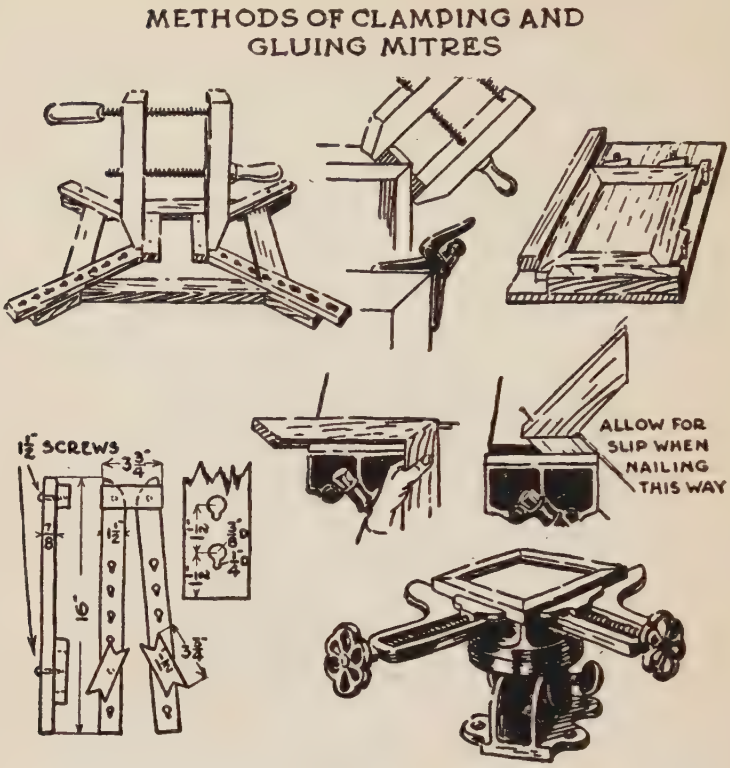


Figure 78

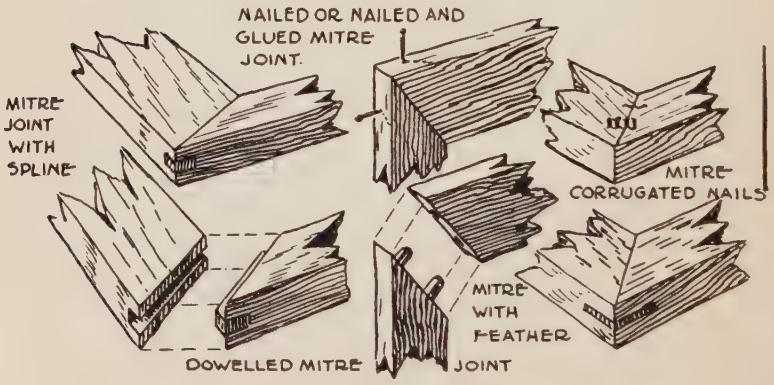


Figure 79

the larger gluing surface, and preventing the pieces from warping.

A slip feather mitre joint has a groove cut part way through it with a saw, into which is glued a thin piece of wood. The excess wood is then trimmed.

Notched and halved joints are perhaps those with which all of us, from our earliest memories, are most familiar.

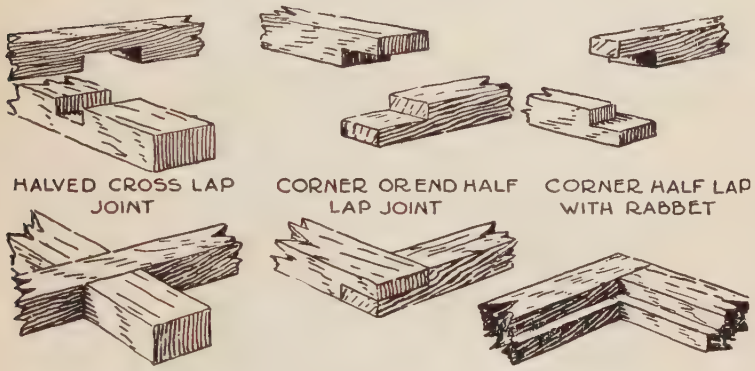


Figure 80

We have referred to them in the first part of the chapter for the construction of screens.

There are many varieties of notched and halved joints. The most important and most frequently used are the middle half-lap, end half-lap and the half-lap with a rabbet.

The middle half-lap is laid out by superimposing each piece upon the other to mark the width of each cut.

The pieces may also be clamped together and the lines for the width of the cut squared across both "work edges" as far apart as the wood is wide. This is sometimes done from a center point measuring half of the width of the wood

on each side of the point. The pieces are then taken apart and the square lines continued across the "work faces" and down on the other edge. The depth of each cut is equal to one-half of the thickness of the pieces and is

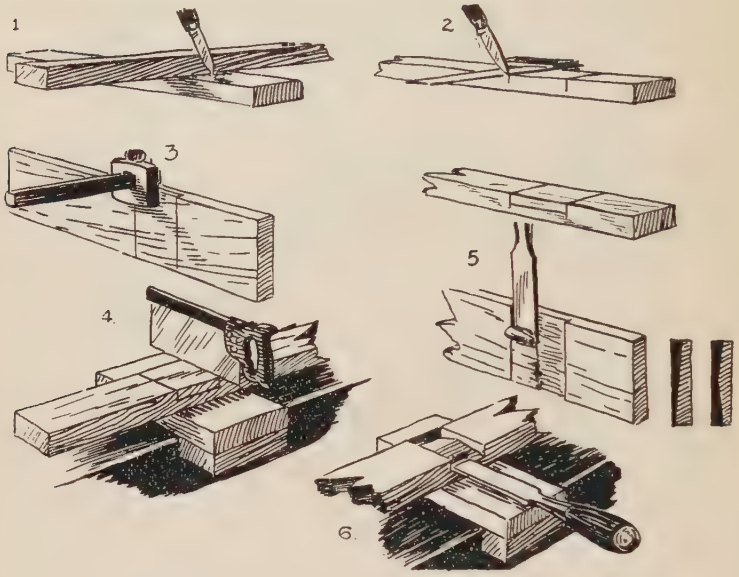


Figure 81

1. Mark the width of the notches.
2. Square the shoulder lines on face and edge.
3. Gauge the depth of the notches.
4. Saw the shoulders.
5. Chisel to the gauge line on each side. To avoid breaking the grain slant the chisel slightly outward.
6. Then finish to a uniform depth.

gauged from the "work face" of both pieces. One piece is cut above the depth line and the other piece is cut below it. The sides or shoulders are then sawed on the waste wood outside of the line. The waste wood is removed to the gauge line by paring if necessary.

It is an aid to chiseling wide cuts to make several saw cuts between the shoulders almost to the gauge line, before chiseling out the waste wood.

The end half-lap joint is laid out and cut in the same manner as the middle lap joint except that as there is only one shoulder to be cut, the line of the bottom is gauged across the end. As the bottom is accessible from the end, it may be sawed out and then trimmed to line with the chisel if necessary.

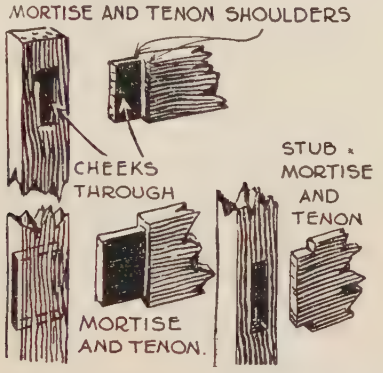


Figure 82

The half-lap joint with a rabbet is laid out and cut in the same way as the other lap joints except that one shoulder is marked close to the end to allow for width of the rabbet.

You know, of course, the general principles of the mortise and tenon joint because it has already been described in two or three different forms in this column.

In cutting out a mortise the waste wood is generally removed by boring a row of holes with an auger bit and trimming the cheeks with a chisel straight and smooth to the line. In order to accomplish this, keep the chisel perpendicular to the face of the wood.

The illustration below shows where the try-square is used for marking guide lines for the tenon, ends of mortises, grooves, gains and for the squaring of an end.

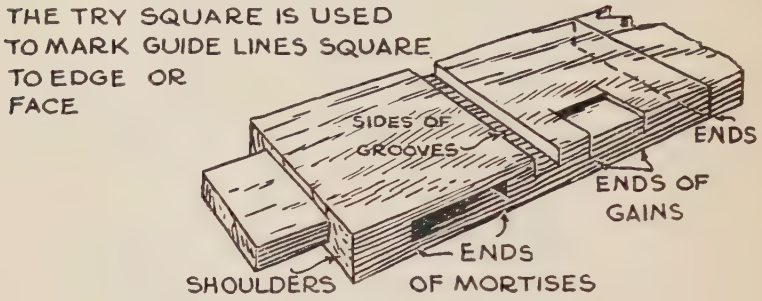


Figure 82½

Mortises may be beaten out with the chisel alone, a heavy mortising chisel being used for the purpose. This is done by driving the chisel, held squarely, with a mallet starting in the center and working to each end. The back

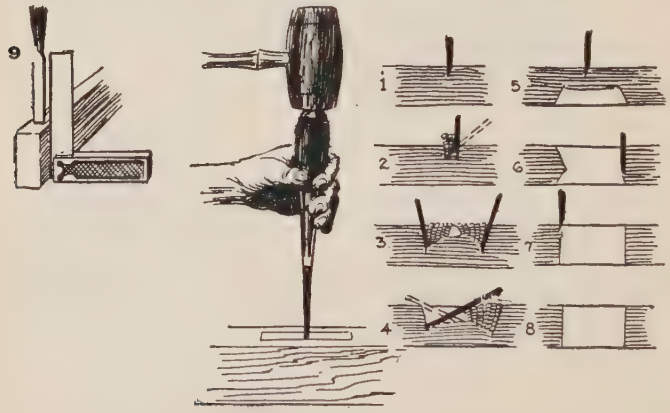


Figure 83

Beating out a mortise.

1. Start in the center.
2. Pry out the first chips.
3. Cut each way to end. Bevel to mortise.
4. Chisel out chips, repeat until about half through.
5. Turn over and start again.
6. True up ends part way through.
7. Finish truing ends.
8. Finish cleaning corners.
9. Test for perpendicularity.

of the chisel faces the ends. The tenon should be tried in the mortise and any part that binds noted and corrected. Glue can be spread evenly on all abutting surfaces and the work clamped together.

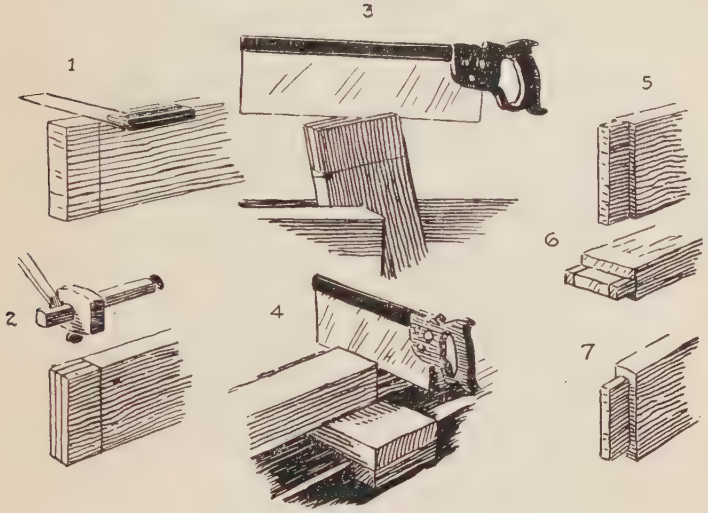


Figure 84

1. Square lines for shoulder marking length of tenon.
2. Set the mortise gauge and use the same setting between spurs to mark both tenon and mortise for thickness of tenon and width of mortise. If the marking gauge is used be sure to draw both lines from the work face.
3. Saw cheeks.
4. Saw shoulders.
5. If necessary finish with a chisel.
6. Mark shoulders on the edges.
7. Saw shoulders on the edges and finish with a chisel.

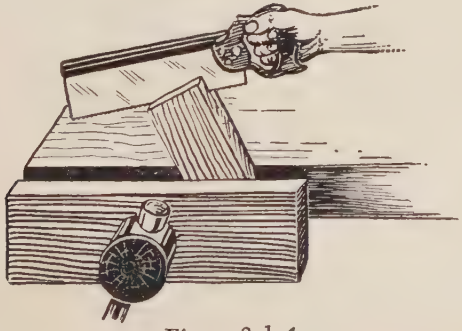


Figure 84½A

Cutting the cheeks of tenons with the back saw.

The haunched mortise and tenon is used in the corners of panel doors. The rails and stiles have grooves to hold the panel. This joint has a short tongue, from the top

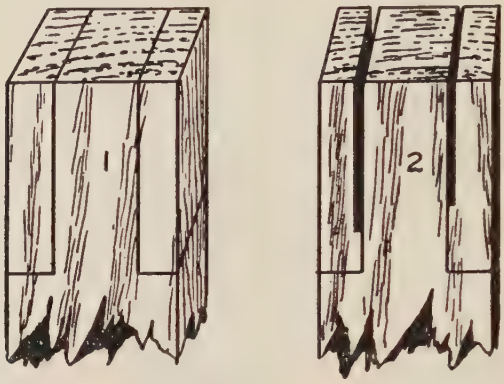
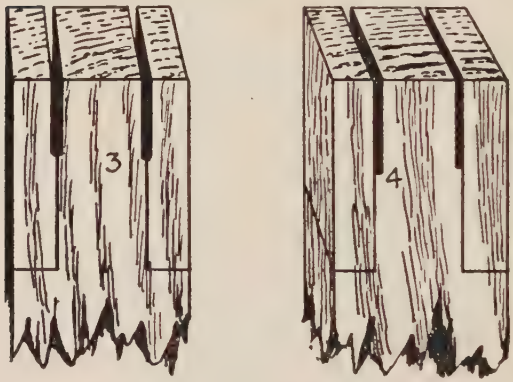


Figure 84½B

1. Tenon marked out.
2. Correct—Saw on waste side of line—tenon left full size.



3 and 4. Incorrect—Sawed on line or inside of line—making tenon too small.

cheek of the tenon to the edge of the wood to fill the part of the groove between the mortise and the end that otherwise would be left open.

The cheeks parallel to the faces and their shoulders are marked and cut in the usual manner. The length of the

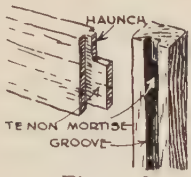


Figure 85

haunch is then measured and squared as long as the groove is deep. The cheeks parallel to the edges are gauged and the work sawed to the lines. The mortise is laid out and

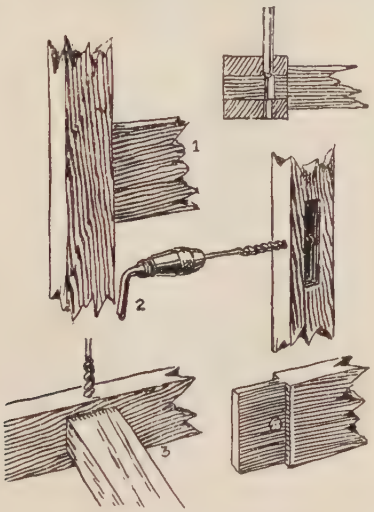


Figure 86

Draw bored and pinned mortise and tenon.

1. Bore hole through the member containing the mortise.
2. Insert tenon in mortise and mark center of hole with bit.
3. Bore hole a little closer to the shoulder so that pin, when driven, will draw up the shoulders tightly.

cut as usual except that the mortise is at the bottom of the groove which is intended to hold the panel.

The pinned mortise and tenon joint is one in which a hole is bored through the sides of the mortise and through the tenon, with a dowel or pin inserted.

The mortise and tenon is laid out and cut as usual, and a hole is bored through the sides of the mortise with an auger bit. The tenon is then inserted and the center of the holes in the sides of the mortise marked on it. The hole in the tenon is bored slightly closer to the shoulder. This is necessary so that when the joint is closed and the pin is driven into the offset hole, the shoulders are drawn up tightly and

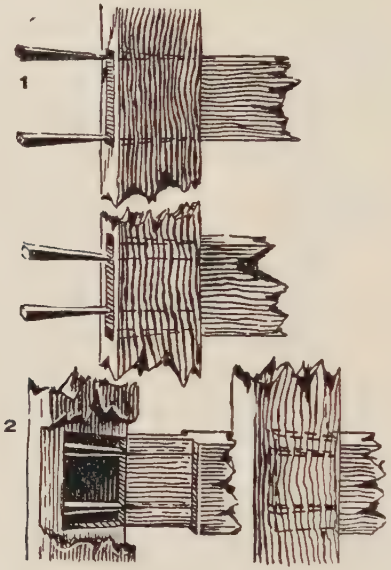


Figure 87

1. Wedged mortise and tenon joints. 2. Fox-tailed mortise and tenon.

held securely. Strength is imparted to the joint independently of the glue.

Wedged mortise and tenon joints are laid out and cut in the same manner as the other mortise and tenon joints except that the mortise is given a flare on the side away from the tenon shoulder.

When the joint is glued up, wedges with glue are driven between the tenon and the end cheeks of the mortise.

Sometimes two saw kerfs are made in the tenon and the glued wedges driven into them. A foxtail mortise and tenon is a wedged blind mortise and tenon. The wedges are started into the saw kerfs before inserting the tenon into the mortise. When the joint is closed, the wedges are driven deeply expanding the tenon by being pressed against the bottom of the mortise.

A bare-faced mortise and tenon is one with one cheek and one shoulder cut.

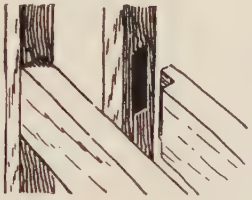


Figure 88
Bare-faced tenon.

An open mortise and tenon or slip joint is used on corners. It is like a through mortise and tenon with one end of the mortise removed.

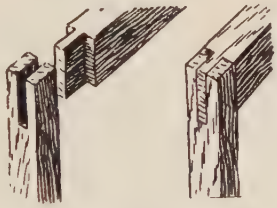


Figure 89
Open mortise and tenon or slip joint.

The only difference is marking and cutting the mortise. The gauge lines for the mortise are extended across the end. The cheeks are sawed in the same way as the cheeks of the tenon, the saw being placed in the waste portion of the wood. The waste wood is finally removed by boring a hole

near the inner end of the mortise and trimming with a chisel or by beating out with a mallet and chisel.

A lock or pin joint consists of a series of open mortises and tenons in line with one another. It is used principally in box construction.

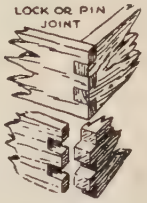


Figure 90

Dovetail joints are difficult to make but they have great strength because of the flaring shapes of the sides of the pins and the dovetails. The projections on the members where the flare is seen on the ends are called pins and the spaces between them the sockets or mortises. The projections on the pieces where the flare is seen on the faces are called

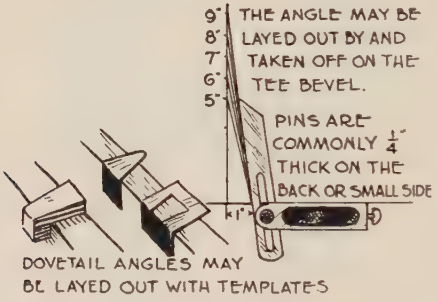


Figure 91

dovetails and the spaces between them the sockets or mortises.

The angle of the dovetails should not be too great or the joint will be weak because of the short grain at the corners. The angle may be laid out by squaring a line from the edge of a board measuring five, six, seven, eight or nine inches

along it from the edge, then measuring one inch from the line along the edge and connecting the points. The angle selected may be transferred to the work with a tee-bevel or a template made of wood or brass.

The strongest dovetails are those in which the pins and the dovetails are the same size, although for appearance sake the dovetails are usually made larger but not greater than four times the width of the pins.

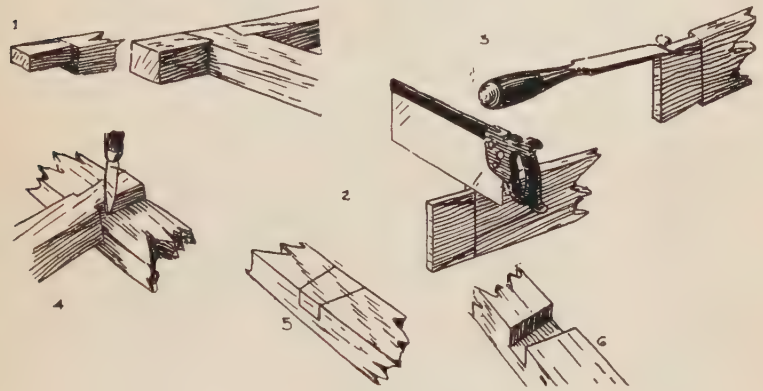


Figure 92

Half-lap dovetail joint.

1. Mark dovetail.
2. Saw shoulders.
3. Chisel dovetail.
4. Lay dovetail on second piece and mark.
5. Square down edges and gauge depth.
6. Cut the socket in the same way as a half-lap notch.

While the thickness of the pin and the width of the dovetails may vary according to the size and nature of the work, it is good practice to make the pin or its corresponding socket on the dovetail piece about a quarter of an inch thick on its narrow side. Mark the lines with great care. Use a well sharpened knife in laying out this joint.

There are several kinds of dovetail joints.

The half-lap dovetail is made by laying out the dovetail member like an end half-lap joint. The angle of the dove-

tail is then marked. The shoulders are sawed and the sides are pared with a chisel. The dovetail is then placed on the second member and the shape marked with a knife or very sharp hard pencil. These lines are squared down the edges and the depth of the notch is gauged. The sides are sawed and the waste wood chiseled to the bottom line, as in a middle half-lap joint.

A single dovetail may be made in the form of two half-pins and a whole dovetail, or as a whole pin fitting into a socket between two half-dovetails.

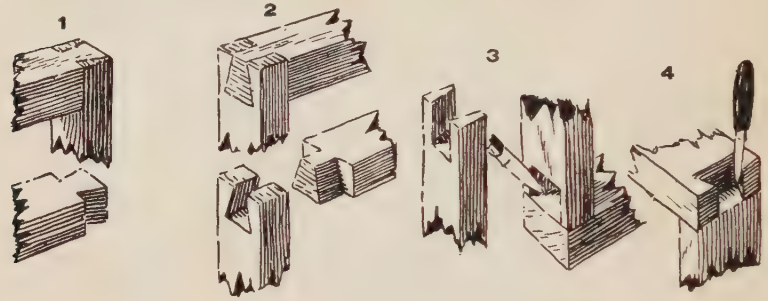


Figure 93

Single dovetail.

1. One dovetail and two half-pins.
2. One pin and two half-dovetails.
3. Marking dovetails from pins.
4. Marking pin from dovetail.

The thickness of each piece of wood is measured on the other piece from the end, to locate the shoulder lines. In the first form the pins are laid out and cut first. The sides are sawed with a back saw or a dovetail saw and the waste removed to the shoulder line with a chisel. This piece is then held on the other member in order to make the shape of the dovetail. These marks are squared across the end and the angles reproduced on the other side. The sides and shoulders are then sawed. In the second form the socket between the two half-dovetails are first marked and cut. The pin is then laid out from it and cut.

A through multiple dovetail joint is a series of single dovetails.

Whether the pins or the sockets should be laid out first depends upon the choice of the woodworker. In any event,

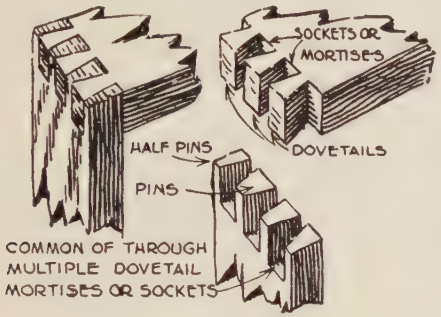


Figure 94

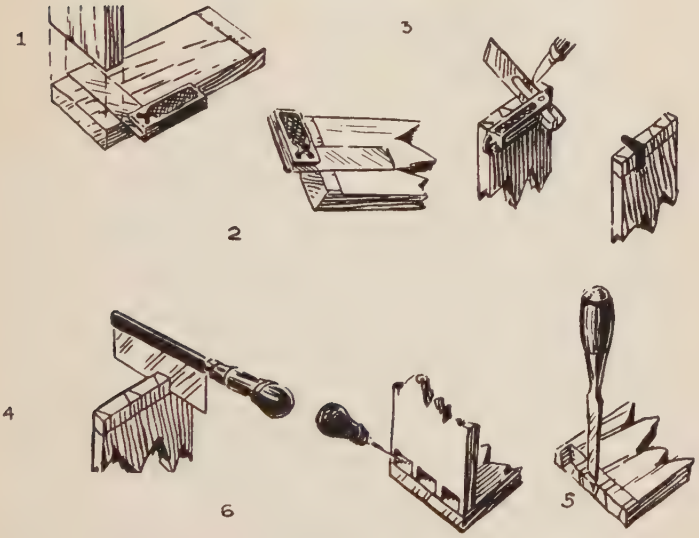


Figure 95

1. Mark the thickness of one piece on the other and square a shoulder line.
2. Divide width into as many parts as dovetails and measure half thickness of pins from each edge and each side of divisions.
3. Square divisions to end, mark slant with bevel and square on the other side. This may also be done with a template.
4. Saw sides of pins.
5. Chisel bottoms of sockets.
6. Mark dovetails from pins with a knife or awl cut in same way as pins.

the shoulder lines are squared first, the distance being determined by the thickness of the corresponding pieces. To lay out the pins, the width of the wood is divided into as many equal parts as there are pins, counting the two outer half-pins as one. Sometimes half of the thickness of a pin is laid off first from each edge on the shoulder line and the intervening space divided. This gives extra strength to

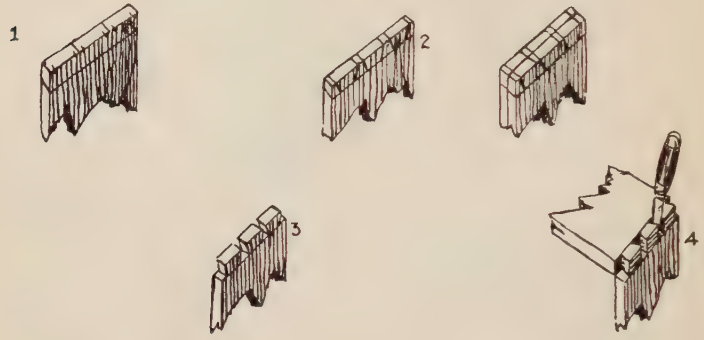


Figure 96

1. Divide into as many parts as dovetails each side and from edges. Measure ½ width of pins. Square shoulder lines.
2. Square line on end and mark sides of dovetail with bevel or template.
3. Cut dovetails with saw and chisel.
4. Pins may be easily marked with a knife or an awl.

the outer half-pin. Half the narrow thickness of a pin, usually $\frac{1}{8}$ inch, is now marked on each side of each point and also from each edge. On these points, lines are squared to the end. The angles are then marked with the tee-bevel or with a template and the lines squared down the other side to the shoulder line. The waste wood is marked to avoid mistakes. The sides are sawed and the waste wood removed with a chisel. The pins are held over the other piece, matching the shoulder line. The dovetails and sockets are then laid out. The waste wood is marked and the sockets are sawed and chiseled.

If careful work has been done throughout, the parts should slip together tightly, making a snug fit.

In marking and cutting the sockets first, several pieces on which the dovetails are to be made, may be clamped together and marked and cut at the same time. The shoulder lines are squared and divided into as many equal parts as there are to be dovetails. Half of a socket is then marked on both sides of the dots and from each edge. Provision may be made for a wider socket on the outside as described for pins. The angles are now marked with the template or the tee-bevel, and the lines are squared across the ends and the angles.

The pieces are taken apart, the shoulder lines finished on the inner faces, marked on the other side. The sides are sawed on the waste wood. The waste wood is removed with a chisel. The pieces to be cut with pins are held singly in the vise, while the dovetail and socket member is held on the end of each and the shape of the pins scribed. The lines are continued down each face to the shoulder lines with the try-square. The sides are now sawed and the waste wood between the pins removed with the chisel.

The half-blind dovetail is used in the fronts of drawers. This joint is illustrated in Figure 66 (sketch 20). It is like the multiple dovetail except that the dovetails do not come through. Only the ends of the pins are seen on the side of the joint. The sides of drawers are thinner than the fronts. The gauge is set the thickness of the side piece, and a shoulder line is marked on the end of the front piece of the drawer from the work face to mark the overlap of the dovetails. The shoulder line on the face of the front piece and the shoulder line for the dovetails on the side piece may be made with the try-square or with the gauge with a single setting. The pins and the sockets are laid out in the same manner as described before, either the pins or

the dovetails first. I like to lay out the dovetails first. The sides of the pins can only be partly sawed, as the cuts extend only part way through the wood.

A rabbet is a recess cut out of the edge of a piece of wood. The bottom is parallel to the face, and the side is parallel to the end or edge, thereby forming a re-entrant square corner for another piece.

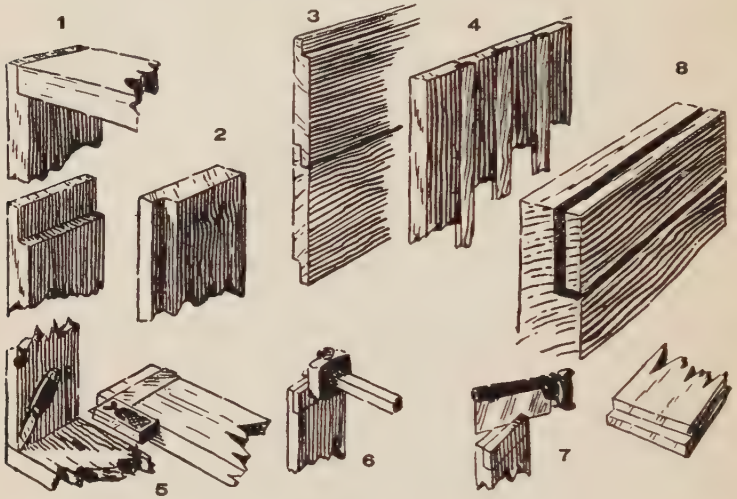


Figure 97
Rabbet joints.

1. Rabbet on end.
2. Rabbet on edge.
3. Ship lap.
4. Rabbet and fillet.
5. Mark thickness of one member and square line for shoulder.
6. Gauge depth of rabbet.
7. Saw on waste wood side of lines and finish with a chisel.
8. A wide or deep rabbet may be cut by plowing two grooves.

A rabbet joint is a square edge or end fitting into a rabbet, two rabbeted edges fitting into each other, or two adjoining rabbets with a spline fitting into them.

A rabbet on the end of a piece of wood is laid out by squaring a line for the side or shoulder across the face and down the edges. This should be as far from the end as the thickness of the joining piece. The depth is then gauged

from the "work face," and lines marked on the two edges and on the end. It may be cut out with a back saw, or the shoulder may be sawed and the bottom cut with a chisel. A Stanley Rabbet Plane will also do this work. A spur is provided for cutting across the grain of the wood.

A rabbet on the edge may be cut with a rabbet or fillister plane or with a combination plane. The depth gauge and the fence regulate the depth and the width of the cut. Wide and deep rabbets may be cut by plowing grooves, one from the face and one from the edge. The thin strip which remains can be cut out with a chisel.

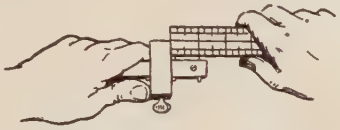


Figure 98

Set the gauge from a rule in order to insure accuracy.

A dado is the groove cut across the grain of a piece of wood into which a second piece is fitted. It is known as a housed joint when the entire end of a second piece fits in the dado. Another form of this joint is the stopped or gained dado, in which the dado does not extend entirely across the face of the work. Besides these are the shoulder housed or dado and rabbet and the dovetailed dado.

To lay out a plain dado, the piece to be housed in is set on the piece in which the dado is to be cut and the width of the dado marked. Lines are then squared across the face of the work through these points and down on both edges. The depth of the dado is then marked with the gauge. The sides may be sawed with or without the aid of a batten tacked on the face of the work corresponding with the line. The waste wood may be removed with a chisel or a router.

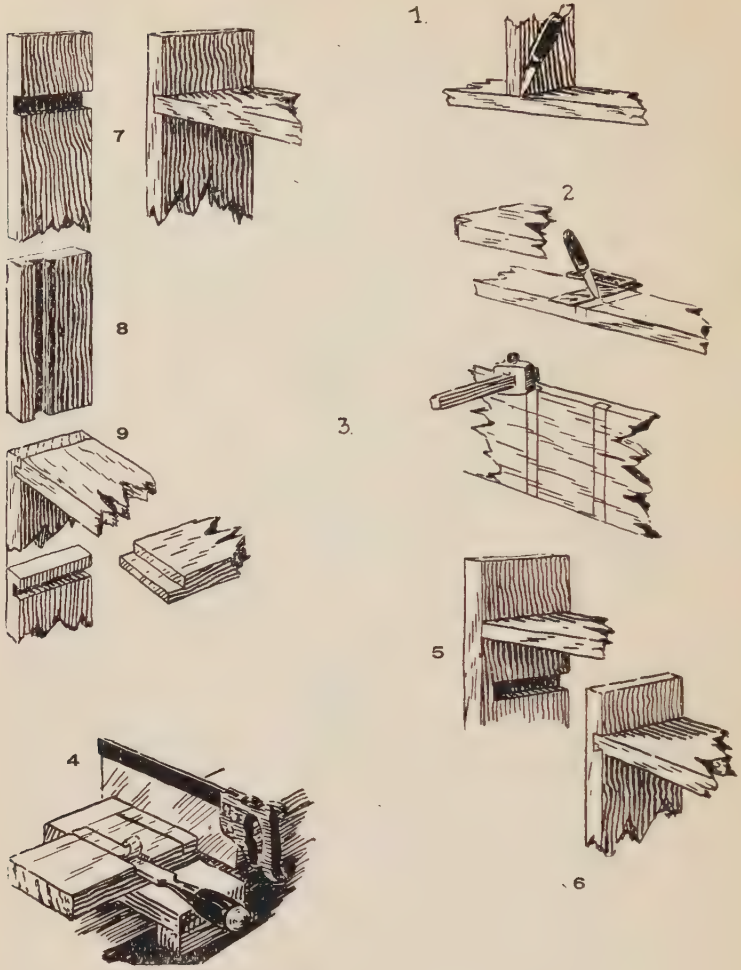


Figure 98½

1. Mark width of dado.
2. Square lines on face and edges for shoulders.
3. Gauge depth of dado.
4. Saw on waste wood side of shoulder lines. Chisel out waste wood to gauge lines and uniform depth.
5. Stopped dado or gain.
6. Dovetail dado.
7. Housed joint.
8. Groove.
9. Shoulder housed or rabbet and dado joint.

Dadoes may also be cut with a dado plane running against a batten tacked on the face of the wood. This plane has two spurs to score the sides of the dado ahead of the cutter. The blade has a skew edge to cut smoothly across the grain, and a depth gauge regulates the depth of the cut.

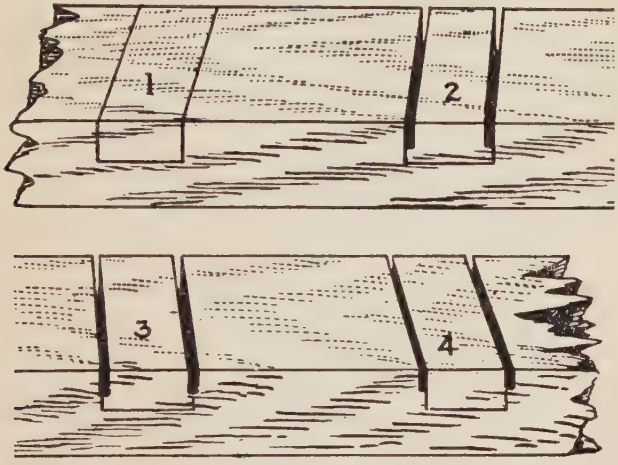


Figure 98¾

1. Groove or dado marked out.
2. Correct—Sawed on waste side between lines.
3 and 4. Incorrect—Groove made too large.

The stopped dado is laid out in the same way as the plain dado, but it does not extend across the full width of the piece. The depth is marked on one edge only, preferably the "work edge." The housed piece has a shoulder, marked and cut in one corner as long as the depth of the gain. In cutting a stopped dado, a small part at the inner end is cut with a chisel to regulate the depth and to help in sawing the sides with the back saw. The bottom is removed with a chisel or router. The sawing and chiseling may be done alternately, a little at a time, in order to avoid cutting the inner part too deep. The depth may be tested with a rule or with a nail driven into a stick.

A dado and rabbet joint is made in the same manner as a plain dado except that a rabbet is first laid out and cut on the end of the housed piece. This joint is frequently used for the corners of boxes.

Now you have a good picture of most of the common joints and also the story of how to make them. If you can make a board square and true, if you have learned how to use your chisel, and have before you the various joints, as a matter of fact there is nothing in the making of furniture and things around the house that you cannot undertake with the greatest confidence in the world.

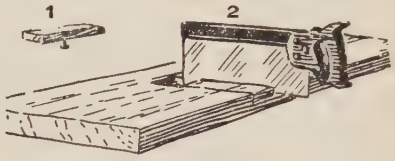


Figure 99

1. A nail in a stick may be used as a depth gauge.
2. In cutting a stopped dado a small part at the inner end is cut with a chisel first to aid in sawing the rest of the shoulders.

Cut with the grain. Mark sharply and accurately with the point of a knife and a marking gauge. Keep your tools sharp. Do a little bit at a time. Nothing should be too much for you.

In proceeding as far as this of course you must get acquainted with hot glue in place of ordinary liquid glue because it is stronger and makes much more satisfactory jobs.

You must also become acquainted with the various kinds of clamps which are used to make the glue effective.

The first important step is to have a clean glue pot. If possible use an iron double boiler, preferably with porcelain lining. An ordinary double boiler or even a tin can set in a pan of water may be used.

An electric glue pot is perhaps the best of all, for with one there is no danger of the glue getting too hot.

Break in pieces as much glue as you expect to need the following day and soak it in water overnight, or say for

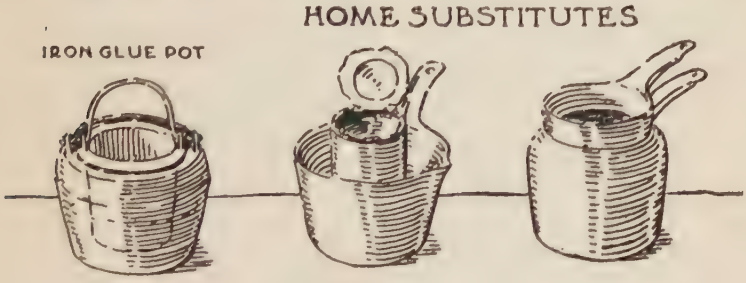


Figure 100

about twelve hours. Mix only a small quantity at a time, as it is much better to mix it fresh as required. Have sufficient water to cover the glue, and when it has softened properly, heat it to about 130 to 150 degrees, but be careful

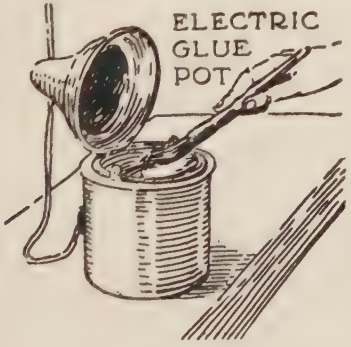


Figure 101

not to boil it. Boiling will weaken it, as well as the adding of water to thin it out after it is first soaked and heated.

When the glue has melted, it should run from the brush in a stream slightly thicker than milk. To prevent evaporation the heat should be shut off when the glue is not in use.

Almost any kind of brush may be used for spreading glue,—one either of bristle, wire, or shredded rattan. It is well to keep a small wooden paddle in the glue pot for stirring and also for wiping the brush on, instead of on the edge of the pot. The paddle can be used for spreading the glue, particularly for working into holes and crevices.

Animal glue is used hot. Fish and vegetable glues are usually liquid glues used cold. Hot glue may be made into a slow setting cold, or liquid glue, by adding either nitric, hydrochloric, or oxalic acid to it.

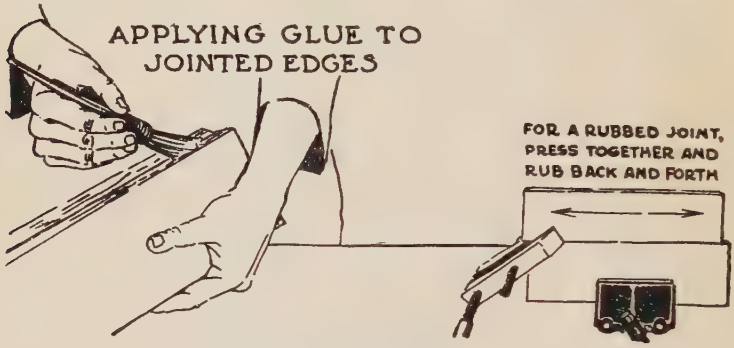


Figure 102

Hot glue will become practically waterproof or insoluble after drying, if about .01 of potassium bichromate is added while the mixture is hot.

Before using hot glue be very particular to have everything in readiness. Have the work and clamps handily arranged for quick use. Put the pieces together that are to be glued, see that they fit and will quickly go together when the glue is applied. Warm the joints so the glue will penetrate into the wood.

When all is ready apply the glue either with a brush or a paddle.

Work quickly, for if the glue chills before the work is finished, it will not hold. Afterwards draw the joints tight with clamps. Test the corners with a try-square and adjust the clamps until the corners are true.

Glue does not hold as a cement between two surfaces, but penetrates the wood while in a liquid state. After it hardens, hundreds of small keys reach out between the wood fibres and join the two pieces of wood firmly together.

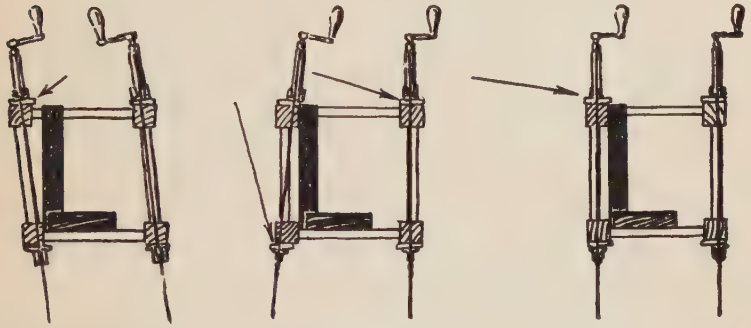


Figure 103

Wherever possible divide the work into small units for gluing, for it will greatly aid in getting the clamps on quickly and in truing the joints. For example, it would be very difficult to glue together the four sides and legs of a small table in one operation and have all sides true and the joints drawn in place before the glue chills.

Common practice is to divide the work into three operations. Glue one end or side, two legs and the intervening rail and stretcher. Then glue the opposite end or side in the same manner. When the glue is hard, remove the clamps, spread glue on the joints, insert the rails and stretchers, and join the two ends, tightly clamped and true.

Long-edged joints, when glued, are put together either by being rubbed or squeezed together by clamps. Before rubbing the edges should be carefully planed with a Stanley

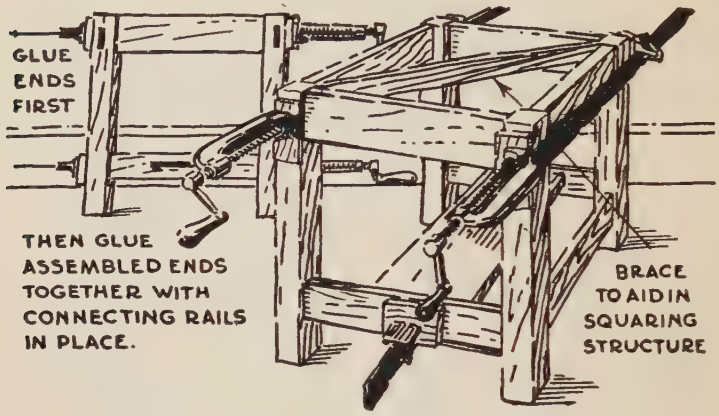


Figure 104

Jointer Plane and the two pieces of wood matched for figure and grain. When the two edges match throughout their length and no cracks show on either side, the glue may

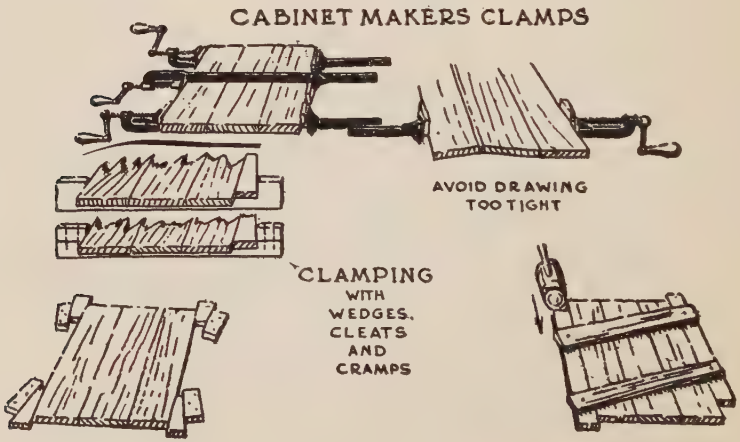


Figure 105

be spread. With a hand screw or a piece of wood clamped on as a guide, press down on the upper board and rub back and forth until the glue begins to set. This will be the

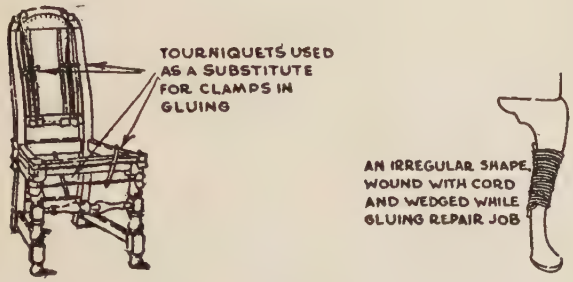


Figure 106

signal to stop rubbing and the work may be carefully placed away to dry.

Squeezed joints are usually left very slightly open in the center. This slight crack will be closed by the clamps. The greater pressure on the ends will counteract the tendency of long edge joints to open on the end.

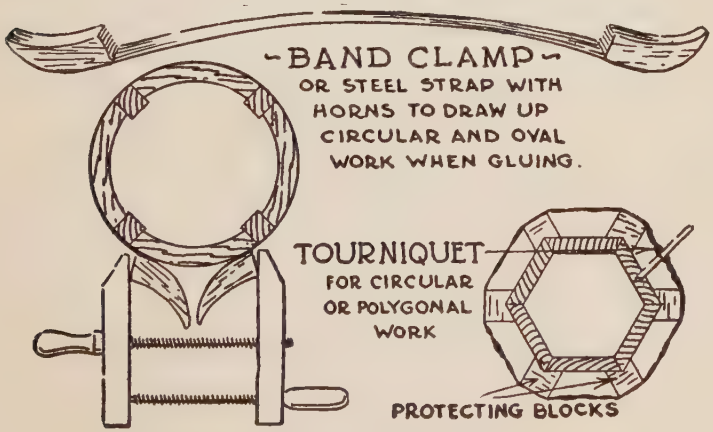


Figure 107

There are many forms of clamps and devices for holding work firmly in place until the glue sets: cabinetmakers' clamps, carriage-makers' clamps, hand screws, vises, wedges, cramps and tourniquets of string or rope.

Shellac, while not a glue, is very useful for sticking paper, rubber, felt, glass, etc., to wood.

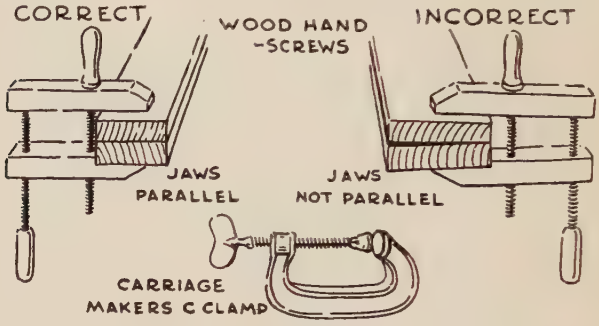


Figure 108

CHAPTER X

Some Fancy Touches

Just as invariably as man or boy has in his hand a good, sharp pocketknife or chisel and a piece of wood he will start decorating it by cutting and paring into interesting shapes or designs.

If you will think back you will remember how you cut notches in a stick and finally conceived the idea of carving your initials wherever you found a willing piece of board. It is in that first wood carving that most of us learn something about the grain of wood and discover that only the sharpest point or edge will really cut across the grain and enable us to get the effect we are after.

Far better than a pocketknife for carving in wood are the regular wood-carver's tools. Most of the remarkable carving is, of course, completely impossible without these special tools, although for the decoration of the upright pieces of the bookrack, described in Chapter VII, the ordinary members of your kit would do.

In the same way most of the special shapes which you wish to give to particular pieces in a bookcase, a kitchen cabinet, or the panels of a door which you are making can be produced by the ordinary tools of the kit but are much easier and much quicker to produce by the use of that remarkable tool known as the combination plane. This is the device which is used by the cabinetmaker for so much of his work, enabling him to produce flutes, beads, reeds, rounded corners, and finishing touches of almost every type. It is really astonishing how much of the work of cabinetmaking can be done with such a device.

Not only does the combination plane cut these various decorative pieces of wood just as you want them, but it also does a great deal of the work for which the amateur ordinarily has to depend upon the saw and chisel. This type of plane is equipped with a large number of cutters of various shapes and it is this fact which makes it possible for them to cut rabbets, dadoes, fillisters and other cuts with which the ambitious amateur puts together his pieces of wood to produce the finished article.

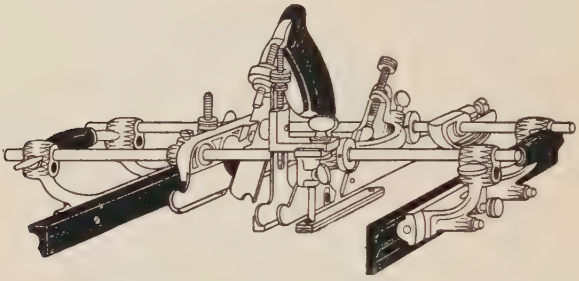


Figure 109
Stanley "Fifty-Five" Plane.

There is another peculiar thing about the combination plane: the bigger and more complete machine is of greater importance to him than it is to the professional craftsman because the amateur rarely makes more than one thing of a kind and his interest in his work and his desire to produce many different kinds of objects means that he has really use for the most complete machine. The professional, working over and over again on the same kind of things, depending more upon the mill for moulding, actually does not have so great a call for the big combination plane as does the man in his own basement or attic workshop.

A large combination plane is practically a finishing mill in itself and of course makes possible work that you could not hope to accomplish without the machine. It is also a

source of saving in time and labor when you have immediate need of a small piece of moulding and it is inconvenient or expensive to go to the mill and have it made.

Perhaps the easiest way to understand, without actually seeing such a machine or beginning its use, just how it works is to look at the sketch (Figure 110) of the various cutters which are furnished with one of these big planes and to look at the names of the cutters themselves. They give you indeed a splendid idea of just what the device will do.

Forty-one additional cutters are carried in stock by the manufacturer, The Stanley Rule & Level Plant, New Britain, Conn., providing a variety of other sizes of many of the cutters furnished with the plane.

Furthermore cutters of practically any form can be used in the plane, which the owner can make from blanks or order from sketch.

Complete instructions for the operation of the plane and its various attachments and cutters are packed with all tools of this type when you buy them.

These planes by themselves overcome many of the difficulties of cutting wood just exactly the way you want to cut it. A guide or fence can be set to insure that your cut is exactly the required distance from the edge of the board. A depth gauge can be set to prevent you from cutting any deeper than you wish to cut. Even more interesting is the fact that these planes cut beautifully across the grain, as in making a dado. Little spurs, sharp and knifelike, adjustable, of course, precede the main cutting blade and score or cut the fibres of the wood on both sides of the cut, which is made by the blade following along behind.

Of course there are other planes besides the combination plane which do the individual jobs, many of which are done by the combination.

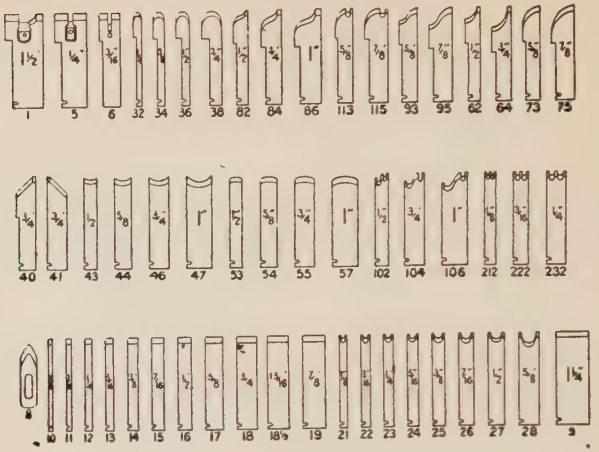


Figure 110

The names of these cutters are as follows:

11 Plow and Dado Cutters	$\frac{1}{8}''$ to $\frac{7}{8}''$
8 Beading Cutters	$\frac{1}{8}''$ to $\frac{5}{8}''$
4 Fluting Cutters	$\frac{1}{4}''$ to $\frac{3}{4}''$
3 Reeding Cutters	$\frac{1}{8}''$ to $\frac{1}{4}''$
2 Match Cutters	$\frac{1}{4}''$ and $\frac{3}{16}''$
1 Sash Cutter	$1\frac{1}{2}''$
1 Fillister Cutter	$1\frac{1}{4}''$
1 Slitting Cutter	
2 Chamfer Cutters	1 Right and 1 Left
4 Hollow Cutters	$\frac{1}{2}''$ to $1''$
4 Round Cutters	$\frac{1}{2}''$ to $1''$
2 Quarter Hollow Cutters	$\frac{1}{2}''$ and $\frac{3}{4}''$
2 Quarter Rounds Cutters	$\frac{5}{8}''$ and $\frac{7}{8}''$
3 Reverse Ogees Cutters	$\frac{1}{2}''$, $\frac{3}{4}''$ and $1''$
2 Roman Ogees Cutters	$\frac{5}{8}''$ and $\frac{7}{8}''$
3 Grecian Ogees Cutters	$\frac{1}{2}''$, $\frac{3}{4}''$ and $1''$
2 Quarter Rounds with Beads	$\frac{5}{8}''$ and $\frac{7}{8}''$
55	

There is the circular plane, the rabbet and fillister plane, the router plane, the curved rabbet plane, the dovetail plane, the match plane, the cabinetmaker's edge plane, the scraper plane, and the various spokeshaves.

It is astonishing to see how these various hand machines have been developed to produce just those parts of the amateur's daily work in his little shop which are most difficult to do.

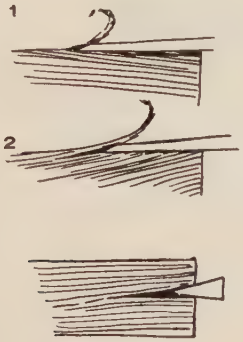


Figure 111

1 Cutting with the grain the fibers are severed, leaving the wood smooth.

2. Cutting against the grain leaves the wood rough. The chisel acts like a wedge, cutting and forcing the fibers apart in advance of the cutting edge. The cut cannot be controled.

When it comes to actual carving there is no machine which will do it for you. You are up against steadiness of hand and eye and the necessity of long practice. Probably more tools have been designed for wood carving than for any other mechanical operation. Each of the tools is, of course, in the class of a chisel and the fundamental requirement of wood carving is to be able to use a chisel skillfully and successfully. The following paragraphs and pictures are a good lesson in the proper use of the chisel.

In cutting with a chisel be very careful, especially when finishing, to make the shavings thin and to cut with the

grain of the wood so the surface will be left smooth and bright.

Figure 112

The chisel cuts more easily and smoothly when slightly slanted in the direction of the cut. This is because the edge is minutely serrated or saw-toothed and because turning has the effect of decreasing the cutting angle of the bevel.

Hold the chisel, when possible, at a slight angle to the cut, instead of straight. This gives a paring or sliding cut that is easier to make, and one that leaves the work smoother both on the end grain and with the grain.

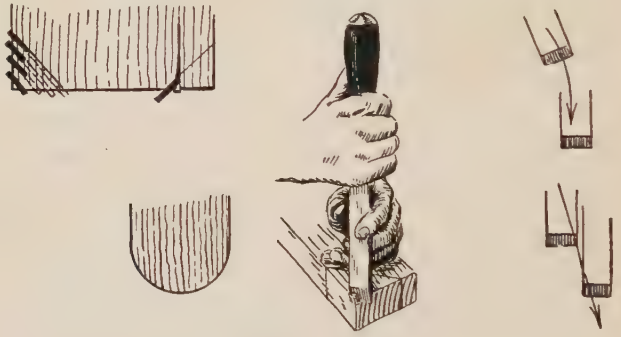


Figure 113

Vertical paring on corners and ends.

1. Observe the grain and start cutting at the edge to avoid splitting the wood.
2. A round corner or end may be pared in the same way.
3. A shearing cut may be made by bringing the chisel from a slanting to a vertical position.
4. The chisel may also be slid to one side as it is pressed down.

A chisel is frequently used for roughing, but in cutting curves on ends, corners, and edges, both convex and concave, it is better to remove as much waste as possible with a saw.

Figure 114

A concave curve may be cut by pressing down on the chisel and at the same time drawing back on the handle. Observe the grain.

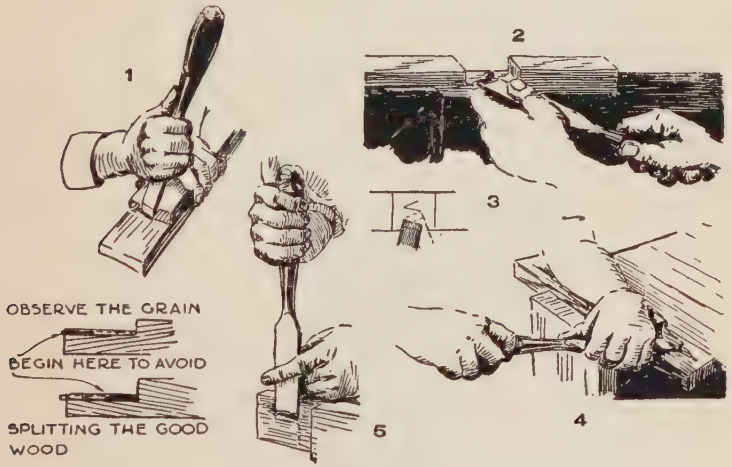


Figure 115

1. To pare a shoulder or to clean a corner, the chisel may be held vertically, then tipped so as to secure a shearing cut when the chisel is drawn toward the workman.
2. Flat or horizontal paring.
3. Take a shearing cut where possible. In close places the chisel may be moved this way.
4. Cut half from each side.
5. Vertical paring across the grain.

A coping saw may be used for curves in thin wood, a compass saw or a turning saw for curves in thick wood, and a back or crosscut saw for straight, oblique cuts. A chisel should then be used to finish the work.

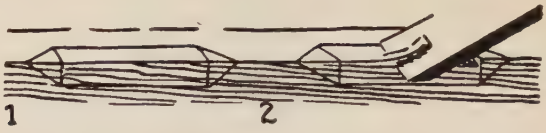


Figure 116

To chisel a stopped chamfer.
1. Lay-out. 2. Rough cutting with bevel down.

The two principal chisel cuts are vertical and horizontal paring. See Figure 115. Always chisel from the line toward

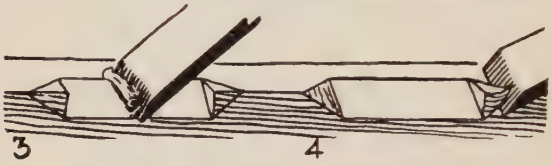


Figure 117

3. Finish cut. A shearing cut. 4. Cut the stops or ends last.

the waste wood, and start in such a way that, if the wood should split, the split will be in the waste wood and not in the good wood.

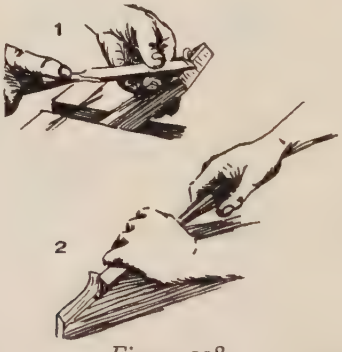


Figure 118

1. Paring a chamfer. 2. Paring a slanting edge or corner.

A chisel may be used to cut a chamfer, a stop chamfer or a rabbet, but with a spokeshave or bull-nose rabbet plane

the work may be easily and decidedly better done. The ends only need be cut with a chisel.

For straight and convex cuts the chisel must be held with the flat side on the work and the bevel up. The left hand holds the chisel. The right hand guides the chisel, applies the

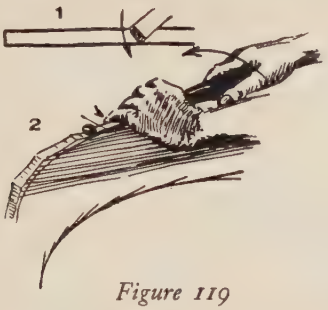


Figure 119

1. A convex curve may be cut in this way.
2. Hold the chisel at all points tangent to the curve to avoid digging in side. Hold chisel sideways to secure a shearing cut.

power down on the wood and acts as a brake. On occasion an exception may be made to this method. When cutting a long groove or a dado in wide wood, the chisel may cut in too deeply. It should then be turned so the bevel is down; this will allow clearance for the handle.

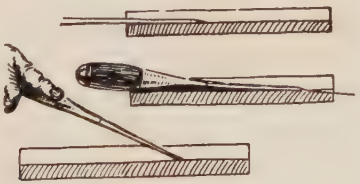


Figure 120

When cutting a dado or a rabbet with a chisel. The chisel is sometimes held bevel down. This gives clearance for handle and fingers.

Gouges, of course, are also chisels, the most important difference being that they are rounded, giving them a curved cutting edge.

They are classed as firmer and paring gouges and furnished with either a flat, medium, or regular sweep from one-eighth to two inches wide.

Firmer gouges may be had with the bevel ground either on the inside or the outside and with tang or socket handle. They are used for cutting hollows and grooves.

Paring gouges are inside ground, that is, the bevel is on the inside, and they have the tang handle. They may be had with off-set handles.

Figure 121

Paring gouges are used to cut surfaces or ends needed to match in irregular forms as, for instance, mouldings. Pattern-makers use these gouges to finish shaping core boxes and for similar work.

The wood-carver's tools and gouges differ from the ordinary tools in that the sides, instead of being parallel, taper toward the shoulder and are beveled on both sides. In ordinary practice the gouges come with eleven different sweeps or curves, ranging from those that are almost flat to those of a deep U-shape.

The small, deep, U-shaped gouges are called Veiners. The larger ones with quick turns are called Fluters. Those with a slight curve are called Flats.

There are three V-shaped tools: acute, medium, and obtuse, called V or Parting tools.

The chisels are square or oblique on the ends and are known as firmers and skew firmers. Skew firmers with bent shanks may be had either for right or left hand.

These various chisels are made in eighteen sizes, ranging from one thirty-second of an inch to one inch, with straight long-bend or short-bend shanks. Veiners are made as small as one sixty-fourth of an inch. The other tools are made in six sizes between one and two inches. Most of the small sizes are shaped either spade or fishtail, which adds to

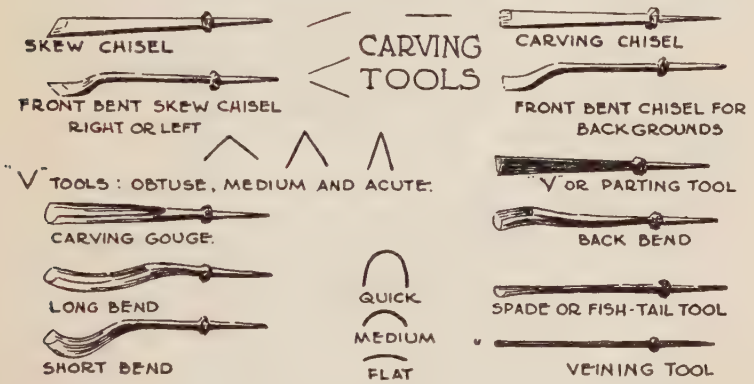


Figure 122

their usefulness in modeling. A greater clearance is given just back of the cutting edge.

To carve a design in low relief, sketch or trace an outline of it on the wood. Go over the outline with a small gouge or a parting tool, and cut on the background side of the line. When doing this observe the direction of the grain on the raised part. Set down the outline with a chisel or gouge that conforms with the curve of the design, using a mallet for tapping. Cut down the background with a flat gouge. Model the surface of the design so as to have an even degree of finish. Complete modeling by putting in details and veining. Clean up the edges and the background. Stamp the background if a stamped texture is desired. Try and

avoid undercutting the outline, or having the edges too sharp or the background too smooth.

Many beautiful yet simple designs on panels, bookracks, cabinets, or chests can easily be made by merely outlining with a small gouge or veiner. The effect may be improved by cutting or stamping down the background and still further by slightly modeling the raised parts. The gouge lends itself to the forming of beautiful units and borders by

Figure 123

1. Trace design on wood or draw it geometrically if its character permits.
2. Outline with a gouge or veiner. Be sure to cut outline on background of line.
3. Set down outline with a mallet and gouges of suitable sweeps, to fit the curves of the design.
4. Cut out background with a flat gouge.
5. Model surface, add detail, clean up corners.

simply combining gouge cuts. The skew chisel and the carving knife are particularly adapted to the type of notching called chip carving. Chip carving is effective if not overdone and may be as simple or ornate as the taste of the carver demands.

Wood carving, of course, is the kind of thing that men spend a lifetime upon and is, of course, one of the great arts. There has been a great deal written upon the subject and any one who wishes to go into it deeply should by all means go to the public library and find what books he can. He will indeed be amply repaid for his interest.

CHAPTER XI

Getting It Ready for Use

There are so many ways of finishing a piece of wood that it seems to me as though every time I got through making something and painting it, oiling, varnishing, or whatever I did, I wished I had another just like it so that I could try a different kind of finish to see how it looked. As a matter of fact an ordinary list of the various ways to preserve wood must include the following seven: Paint, Enamel, Stain, Oil Polish, Wax Polish, French Polish and Varnish.

Not so many years ago it was necessary for the workman to purchase the raw materials, such as oil pigment, turpentine, and various oxides for making up his paint. He also made up even his own varnish. But those days are gone, the paint and varnish manufacturers make a great variety and they are far better than even the most skilled home workman could possibly hope to do. Complete directions, of course, are always furnished with the prepared paints, varnishes, and stains, but not all the rules of good work are given, nevertheless. Before you paint anything, unless you are an old hand at it, it would be wise to read the tips which follow.

Here are some on painting outdoors after you have put a new rail on the porch stairs, or put a new piece of siding on the outside of a house, or perhaps even tackled a bigger job.

1. Do not fail to stir the paint thoroughly.
2. Do not paint in very cold or frosty weather.
3. Do not paint upon wet or moist surfaces, or dirty and greasy surfaces.

4. Shellac the knots to prevent the pitch or sap from coming through the paint.

5. Do not paint over blistered, loose, cracked, or peeling paint. Remove these imperfections.

6. Do not apply second or third coats until previous ones are dry.

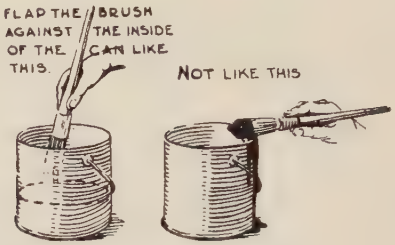


Figure 124

7. Putty all holes after the first or priming coat.

8. Do not use cheap paint oils—use Pure Linseed Oils.

9. Do not use old worn-out brushes and expect a good job.

Figure 125

10. Brush the paint in. Do not flow it on.

11. Do not prime with ochre or cheap paint.

12. Several thin coats are better than one or two thick coats.

Most of these points apply also to painting inside. The composition of the paint is a little bit different but the method of application is very much the same.

In painting walls, of course, it is unusally necessary to size the plaster or surface upon which you are going to paint.

A size is a material which is painted on to a surface in order to leave upon that surface an impervious film through which the paint vehicle will not penetrate. For instance, a plaster wall will have a considerable amount of absorptive capacity for any liquid. Obviously, if this wall could be coated with an impervious film and hence the absorption of the paint lessened, the net result might be a saving in expense and an even color on the surface when dry.

Enameling is really rather difficult but the results are worth a great deal of effort because a hard, durable coating can be had with enamel which nothing else will produce.

All enamels require undercoats to procure the proper foundation before applying the finish coat or coats. These undercoats dry with a flat finish. The use of an undercoat is necessary because the enamel is partly transparent. This condition of the enamel is due to its being made with the best light colored varnish so that a proper gloss and flow may be obtained.

The surface to be enameled is given one, two or more coats of undercoat, each of which should be lightly sanded. Then one to two coats of the enamel are applied as desired to obtain the finish required.

In connection with enamels, it may be well to mention that enamels in certain colors are also made for floors.

Stains are divided into many different classes. The most common ones are the water stains, the chemical stains, the spirit stains, the oil stains, and the varnish stains. There are also the market combination stains and fillers, that is to say, the wood is stained and filled at the same time.

Water stains are water soluble dyes. These water soluble dyes in some instances have a tendency to fade, although if care is taken in their selection trouble may not

be encountered. Chemical stains may have no color of themselves, but have a chemical action upon the wood, thereby producing a color. For instance, ammonia is used to give wood an appearance of age, and to open the grain. Some stains penetrate more deeply and color more evenly when the wood has first been treated with ammonia. This ammonia treating is called "fuming" and is done by exposing the work to ammonia fumes in an air-tight box or room. The ammonia may be painted on similar to water stain. Another instance is bichromate of potash, which produces an old appearance on mahogany, chestnut, or walnut. The immediate effect is a yellow color but in time the action of the daylight and oiling changes it to brown.

Water and chemical stains on application have the effect of raising the grain of the wood, and therefore require sanding lightly before any further part of the finishing process is done. To bring this raising of the grain to a minimum, the wood is given an application of water with a sponge or brush. This, as it dries, raises the grain, which then can be sanded. Then an application of the stain is made which, after drying, may require a further very slight sanding.

Spirit stains are dyes dissolved in alcohol or naphtha.

Oil stains represent merely the solution of oil soluble materials in their respective vehicles, and the subsequent suspension of pigments in these vehicles.

Varnish stains are very similar to oil stains in that they are varnishes containing either oil soluble colors or merely pigments suspended in them, and they are used mainly where an attempt is made to save money by combining staining and varnishing.

Probably the method which produces the best results in wood finishing is that in which water or chemical stains are employed. They produce good colors which are sufficiently

transparent so that the natural grain and beauty of the wood is apparent. Stains containing insoluble pigments are very apt to produce a cloudy or muddy effect, thereby partially covering up the grain of the wood.

In staining wood in the case of water spirit and oil stains apply the stain freely and quickly with a sponge, rag, or brush, working with the grain. Work in such a manner as to avoid overlapping edges. Considerable care must be exercised in applying water stains, as the work must be done quickly and evenly.

Oil stains are probably the easiest stains to handle.

With the exception of varnish and chemical stains, as the color begins to dry, rub off with a soft rag any surplus stain not absorbed by the wood. This will prevent the grain becoming obscured or clouded. This applies especially to oil stains and to a combined stain and filler. Cover the surface well, but do not apply the stain too lavishly.

A great many of the woods have large open pores and require filling in order to get an even final result. Oak, for instance, which has been varnished but has not been filled will not have a satisfactorily smooth finish because of the varying porosity of wood. These fillers are made in different shades for different woods. They are sold in paste form to be thinned down with turpentine.

The filler should be of the consistency of a varnish and applied with a good brush, rubbed well into the grain and pores of the wood. When the filler is fairly well set, which is when it begins to show flat, rub off the excess from the surface of the wood with a cloth or burlap pad, always rubbing across the grain. Be sure no streaks are left on the surface and no surplus filler left in the corners.

Only fill as much surface at a time as can be wiped off before it sets too hard to rub off without rolling up.

All rubbing or wiping must be done across the grain.

The filler should dry about thirty-six hours, depending somewhat on the temperature of the room where work is done. When dry, go over with No. o sandpaper and proceed with finishing as desired.

Shellac may be used to make the final finish on top of stain. It dries very quickly and is very hard but will not stand up under moisture. It is used frequently as a liquid filler underneath varnish or wax polish.

After the wood has been filled and filler has thoroughly dried it should be sandpapered very lightly and a thin coat of shellac should be applied. Shellac varnish sets quickly and does not "level up." When you put it on you must do it quickly with long, even strokes. If you omit a single spot your coating fails because you cannot go back afterwards and touch it up the way you could with paint.

One of the simplest and most successful finishes for things you make around the house is a coat of stain followed by several coats of shellac, each rubbed with fine sandpaper and then a rubbing of wax.

The French polish finish is the finest shellac finish that there is. It takes time and care to produce it.

The wood must be made perfectly smooth, then filled and again smoothed. To bring out the grain it is sometimes oiled. Two or three coats of shellac are applied and rubbed down with No. oo sandpaper. This forms a body on which to work and prevents the oil from being absorbed by the wood.

Prepare three wads of clean cotton waste and three pieces of clean, soft muslin, free from lint or sizing, in which to wrap them. An old linen handkerchief is good to use. Dip one of the wads in shellac, just enough so that it will squeeze out readily, then wrap it in the cover. The polishing consists of rubbing on the shellac with a circular motion. Do not allow the pad to rest on the work at any

time. After the shellac has been applied and is dry, dust a little pumice on the work and also sprinkle on a few drops of linseed oil. Now use the second rubber, continuing the circular motion and rub until the work presents an even dull surface and then wipe it clean. Continue this three or four times, allowing sufficient time for the work to dry between each rubbing. Finally with a very little

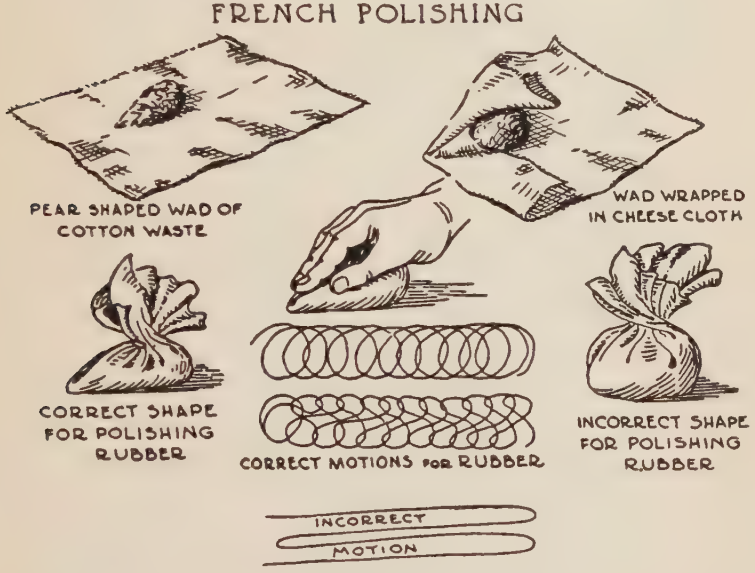


Figure 126

alcohol on the third rubber, go over the work quickly and wipe off the polishing marks. Do not have too much alcohol on the rubber, and be careful not to let it stop on the work, or a dull burned spot will show.

As the rubbers are said to improve with age, they should be kept in separate, tightly covered bottles to keep them soft. At least the muslin cover should be washed in strong borax, then rinsed and dried.

The varnish finishes are easier to produce. The wood, of course, must be filled and then shellacked when it is ready

for a light sandpapering for finishing. The usual varnish finish consists of one or two coats of rubbing varnish followed by a coat of finishing materials.

There are numerous varnishes used in finishing, both for cabinetwork and also for use in the home. In varnishing, it is necessary for good work to have the varnish at a temperature of about 65 to 70 degrees F.

Varnish should be applied with a good grade brush, perfectly clean. A brush used for varnish should not be used in paint, enamel, or other mixtures.

If varnish is to be applied on floors, a good grade floor varnish should be used. This varnish also may be used for a window trim and doors, although special varnishes are made for this work.

In cabinet or wood work, it is necessary to have a rubbing varnish in order to build up a smooth surface before applying the finishing varnishes, which generally contain more oils and require a longer time to dry.

The time required between all these coats varies with the stains, fillers, and varnishes used, but never should be under twenty-four hours and preferably longer. Each coat must be thoroughly dry before the next coat is applied.

After applying the rubbing varnish and allowing it to dry, it is rubbed with a felt pad, moistened in water and pumice stone, to a smooth finish, being careful not to rub through the coat of varnish. Rubbing should always be done in the direction of the grain, not with a circular motion. Do not rub part of work on same panel in different directions.

The work is now washed off with a sponge and water, making sure to leave none of the pumice. It is then dried with a chamois skin and allowed to dry thoroughly before applying the next coat of varnish. If it is desirous to leave the work in the rubbed effect, it may be done either now or

after applying the second coat or rubbing varnish, and proceeding as before. If a gloss effect is desired, a finishing varnish is applied and allowed to dry thoroughly.

On certain work where the varnish film has extremely hard usage such as on floors, it has been definitely proven

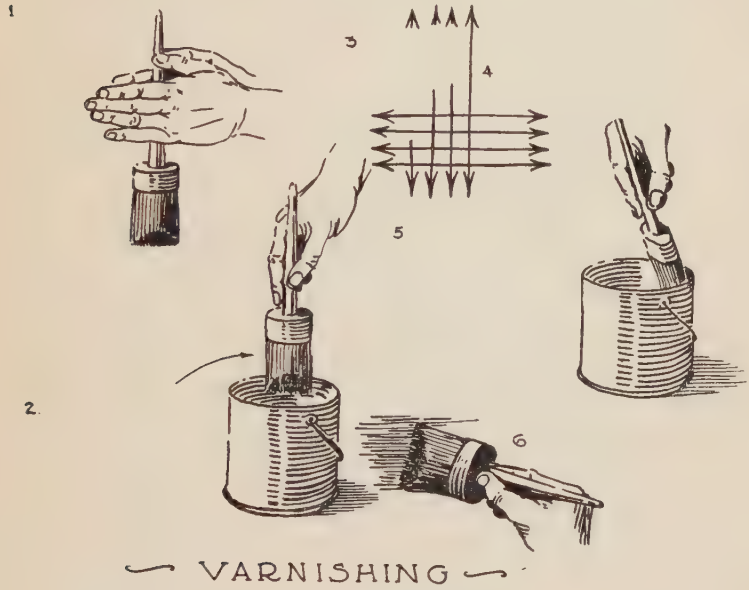


Figure 127

1. Before using, twirl brush between the hands to remove oil or turpentine.
2. Raise the brush from the can like this.
3. Stroke up and down.
4. Then stroke across.
5. Draw surplus varnish from the brush on the inside of the can.
6. Give finishing strokes lightly.

that a coat of shellac after the filler is injurious. The shellac coat is extremely brittle and when a flexible film of varnish is applied over this and this varnish film receives extremely hard service, the shellac coating causes the varnish coat to become loosened from the wood surface. Therefore varnish should not be applied on floors over shellac.

Rubbing and polishing are important branches of finishing. It is here that the final touches are often added when a dull or polished finish is required.

If a dull finish is required, the finish coat of varnish, after thoroughly drying, is rubbed down with very finely powdered pumice sprinkled on a felt pad and soaked in water.

On the other hand, if a polished surface is required, the work after having been carefully rubbed down with pumice stone and water is then polished with very finely powdered rotten stone and crude oil or sweet oil.

Very soft cotton waste makes an ideal polishing pad. This pad is moistened with water and then wrung as dry as possible. Rotten stone and a polishing oil, which have been thoroughly mixed together into a thin cream, is then applied to the pad and the polishing is begun. The motion is not the same as polishing, but it is a straight stroke extending from one end of the surface to the other.

After the polish has been brought to the highest point possible, its brilliancy may be deepened by rubbing rapidly with the bare hand, using the least possible quantity of oil polish, just enough to prevent the hands sticking to the finish. This rubbing by hand should be done in a circular motion.

If a greasy appearance persists after polishing clean the polish off with a soft cloth moistened with alcohol or benzolene. The greatest care must be exercised in doing this. Have but a very small quantity of alcohol on the cloth and go over the surface very lightly, using a circular motion. Do not pause or stop. If there is too much alcohol on the cloth, it is sure to burn into the varnish and destroy the polish.

Waxes are made in the paste and liquid form and of different mixtures. They are easily applied with a piece

of cheesecloth or a brush, and after allowing to dry are briskly rubbed until a smooth polish is accomplished. Waxes are used on floors, linoleum, table tops, etc. Wax polishing may be done over unfilled wood or over wood filled with a paste filler, or a thin coating of shellac. The wax is applied in the form of a thin film and after being allowed to harden, it is rubbed vigorously with a piece of cheese-

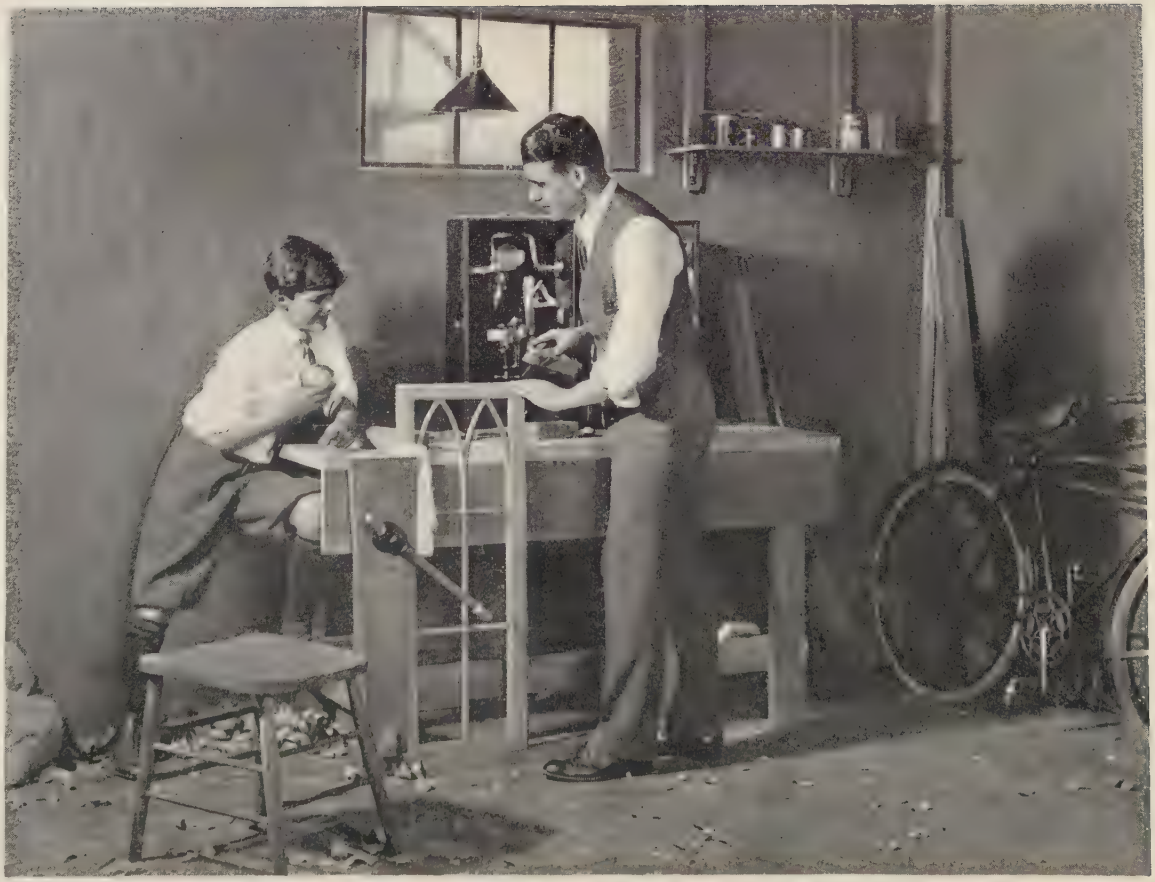
Figure 128

Figure 129

To apply wax by hand, take a little wax on the fingers and rub vigorously.

cloth to obtain a polish. This must be done several times to secure a good gloss.

Oil polish may be used on filled or unfilled wood. Oil polish is durable and very simple to prepare. Equal parts of linseed oil and turpentine, if applied sparingly, rubbed vigorously and repeated frequently, will give a beautiful and lasting semi-gloss. This finish is excellent in its resistance to heat and watermarks, and is used generally on dining-room tables.



"There! That china-closet door won't bother Mother again."

CHAPTER XII

Things Around the House

With the knowledge which you already have you should indeed be able to make almost anything you like and also to make any repairs around the house which becomes necessary. One of the most interesting problems which is likely to arise is the old one of hanging a door. Now that you know how to make a mortise, how to mark and gauge accurately, it should arouse no fears in you at all. For those are the problems of door hanging. The bugbear that used to reside in my mind was that of lining up the leaves of hinges. I saw very plainly that if the hinges did not line up perfectly the opening of the door would pull off either one or the other of the two. Worse yet, it might be impossible to open the door at all after I got through with it.

A door which you have made yourself or a stock door supplied by the mill or sash and door dealer will come to the job oversize as to width and height. Door openings in old buildings may be square and with sides perfectly parallel or they may not be, owing to settling of the building or warping and twisting of the framework. Before proceeding to work down the door to fit the opening, it is important to make sure just what kind of an opening you are dealing with. The edge of the hinge stile should be perfectly square and should be planed down smooth, removing sufficient material so that when the opposite lock stile is trimmed down the panels of the door will be about as near the casing on the lock side as they are on the hinge side. In other words, roughly speaking, it is desirable to have the two stiles of the finished door approximately equal in width.

After planing the hinge stile, the top should be roughly fitted to the top jamb by sawing or planing or both. In planing down the edge of the lock stile, the cut ordinarily is made at right angles to the face of the stile. You will find in the case of thick doors that it will be beneficial to finish this edge on a slight bevel rather than precisely square with the face of the door, so that the beveled portion will more readily clear the jamb when the door is opened or closed. Sometimes locks are made with beveled faces with this same idea in mind.

The bottom end of the door now is trimmed off by sawing and here it is necessary to consider whether there is a threshold or not. Where a threshold is used the door may be fitted rather closely, probably so as to swing $\frac{1}{8}$ inch over the threshold. Where thresholds are not used it usually is necessary to cut the door short so as to clear the floor by $\frac{3}{8}$ inch to $\frac{1}{2}$ inch, so that if rugs are used on the floor the door will swing clear of them.

When the door is properly fitted to its opening it should have about $\frac{1}{16}$ inch clearance on the hinge side, $\frac{1}{16}$ inch to $\frac{1}{8}$ inch on the lock side, $\frac{1}{8}$ inch at the top jamb, and proper clearance at the bottom, as above explained. Two wedges should then be driven beneath the door to hold it in its proper position in the opening while certain measurements are taken. Measuring on the hinge stile down from the top, mark off with a sharp knife a cut 6 inches from the top jamb; this cut to be partly on the door and partly on the casing. Measuring up from the floor, make a similar cut on the door and casing 10 inches above the floor. These marks should, of course, exactly register between the door and the casing inasmuch as all measurements for mortises are to be taken from them.

The mark 6 inches from the top represents the level of the top edge of the upper butt. The lower mark represents the

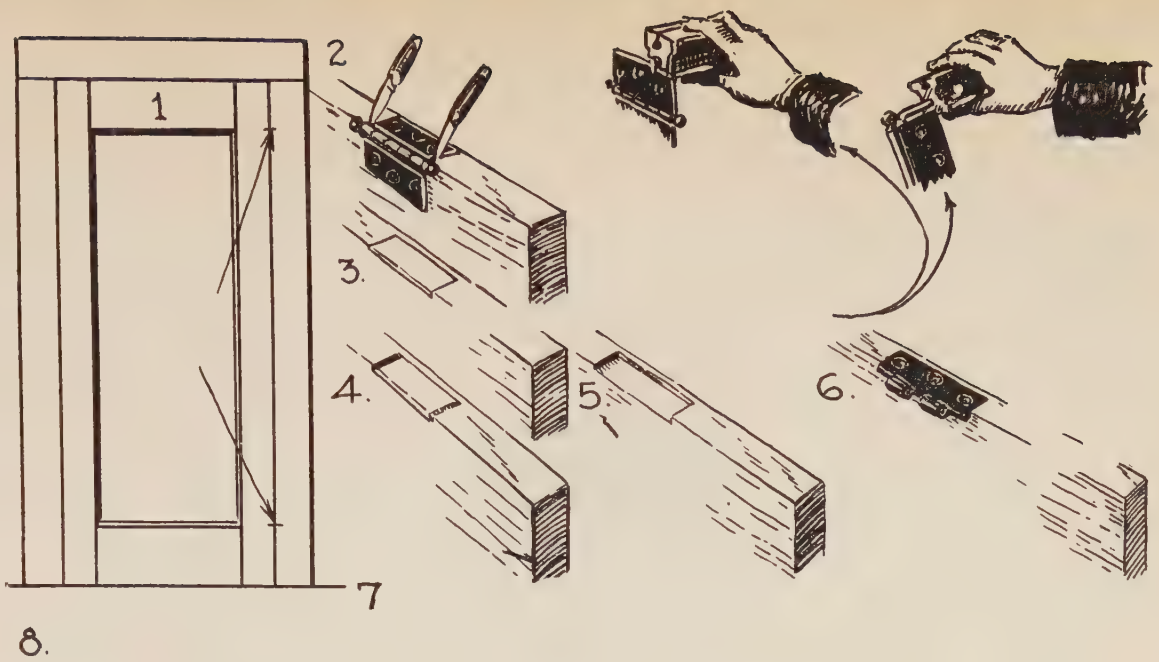


Figure 130

To hang a door.

1. Fit door. Hold in position and mark the place for the hinges on both door and frame.
2. Mark the length of butts.
3. Finish marking width and depth. For depth set the gauge to the thickness of the leaf. For width set the gauge to the width of the leaf or slightly less according to the clearance desired.
4. Notch ends of gain.
5. Chisel out gain.
6. Place one leaf of butt and screw it in place.
7. Repeat for each hinge and duplicate on frame.
8. Fit door, insert pins, test hang. If the notch is too deep, insert a piece of cardboard in gain. If not deep enough, remove leaf and cut deeper.

bottom edge of the lower butt. Doors will operate very much more satisfactorily if a third butt is provided exactly midway between the other two. This third butt not only provides additional bearing and wearing areas, thus tending to prolong the life of the hardware, but has the extremely important advantage of resisting warping and springing of the door and helping the lock to maintain its proper alignment for smooth, satisfactory performance. After the three marks are made on the door and correspondingly on the

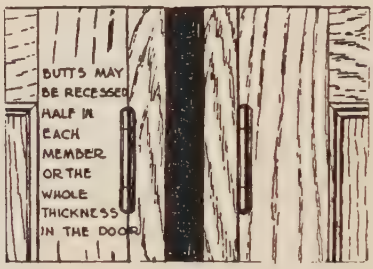


Figure 131

casing, the door may be removed from the opening and the proper gains made on the edge of the door and casing for receiving the leaves of the butts. By using a butt gauge the work of laying out the outline of the butts may be simplified. It is customary to cut the mortises in the door to a point ¼ inch from the inside face, except where the door is made of very thin stock, that is, leave ¼ inch of wood beyond the edge of the leaf. On the casing this space should be increased by about 1/16 inch so that as the door works in the casing there will be 1/16 inch clearance between the door and rabbet.

In the case of loose pin butts, the pins may be withdrawn

and the leaves of the butts fastened in place separately on the casing and on the door, after which the door is again put back into place, fitting the knuckles of the hinges together, whereupon the pins may be replaced in the butts.

If the work has been accurately done and no miscalculations made, the door will swing freely. If, however, you discover there is a tendency to bind, the trouble may be corrected by loosening one of the leaves and packing with cardboard or paper or perhaps by removing one of the leaves and slightly deepening its mortise.

Now comes the time to fasten on your locks. The easiest one, of course, is the rim lock, so-called because no mortise is required.

To apply a rim lock, hold the lock in place with the lock face even with the edge of the door. Mark the screw holes, the knob spindle hole, and the keyholes with a Stanley Awl. Bore the holes and screw the lock into place, insert the knob spindle and attach the knobs. Screw on the escutcheon plate over the keyhole. Close the door and locate the position of the strike plate on the door jamb and screw it in place.

To apply a mortise lock, place it against the edge of the door with the lock face against the edge and locate the knob spindle hole and the keyhole with an awl.

Bore these holes. Draw a line in the center of the edge of the door stile parallel with the face and bore holes centering on it for the mortise to receive the box of the lock. Use an auger bit the diameter of the thickness of the lock box. Trim out the mortise nicely with a chisel to straighten the sides and insert the lock.

Mark around the lock face with a knife, remove the lock and cut the gain with a chisel deep enough to make the lock face set slightly lower than the edge of the door. Screw the lock fast, insert the knob spindle, attach the knob and

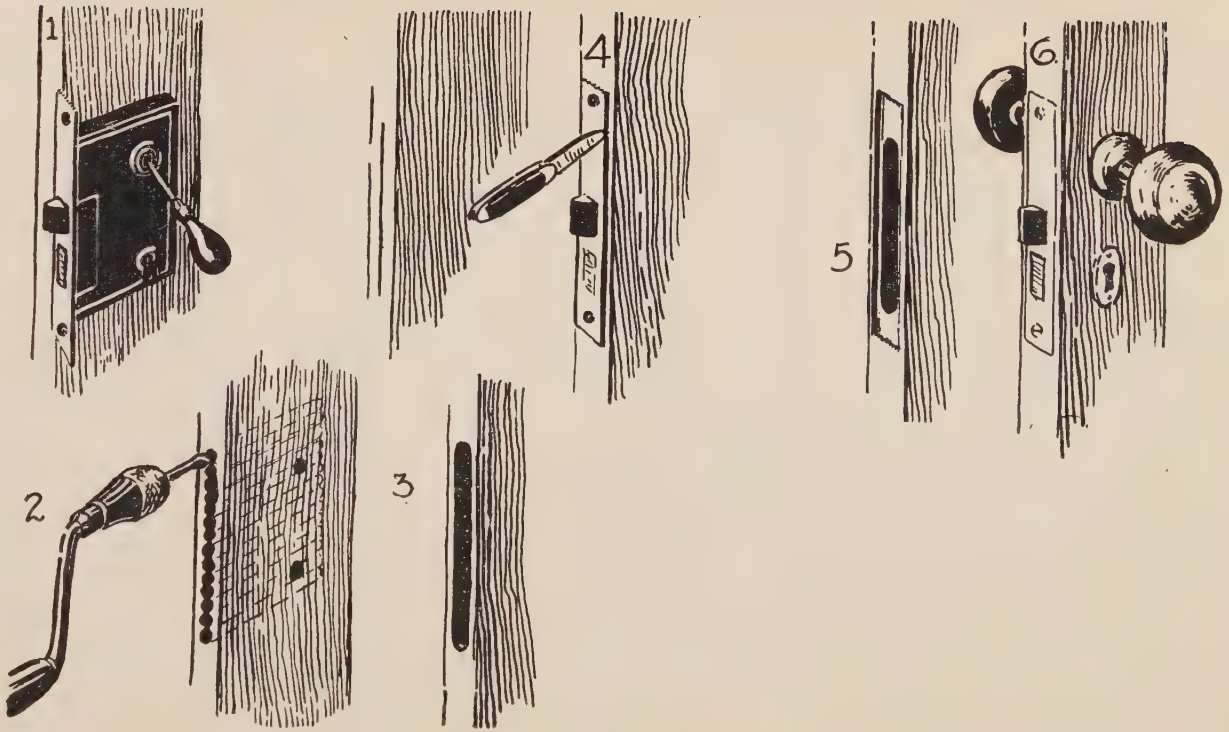


Figure 132

To fit a mortise lock.

1. Hold lock face against edge of door. Mark for length of mortise, knob spindle and keyholes. Bore them.
2. On center line bore out mortise.
3. Chisel sides of mortise.
4. Insert lock and mark sides of gain with a knife.
5. Chisel out gain for the lock face.
6. Insert lock, screw the lock face fast, insert spindle, attach plates and knobs and escutcheons.
7. Locate the strike on the door frame, recess and attach it.

the escutcheon plate. It is now necessary to close the door in order to locate the vertical position of the strike plate on the jamb. Locate its horizontal distance from the edge by carefully measuring from the face of the door to the catch. Hold the plate in position and scribe around it. Cut the gain as deep as the plate is thick. The plate may now be screwed into place. With the chisel cut out the wood back of the openings to receive the catch and bolt.

There are, of course, hundreds of tools in common everyday use which have not been described but you can become acquainted with most of them very quickly and easily at the hardware store. There you will see for instance hammers of every type, innumerable files and rasps; there are axes and mauls, mallets and sledges. All of them, of course, have a little bit of technique of their own, technique that comes quickly when the need arises and you have work for the tool to do.

But there are only a few things left which are of great importance to the amateur shop worker on which some tips might be valuable. Take the matter of using a hammer. I remember an apprentice who worked for days attempting to learn how quickly and efficiently to drive nails, yet it is a simple thing which you undoubtedly have already learned.

In driving nails, steady the nail with the left hand and with the right hand grasp the hammer handle firmly at the end.

At first give a slight tap to set the nail and also to determine the aim. The blows that follow should be precise and well directed, with a motion chiefly of the wrist and forearm.

Be careful to strike the nail squarely on the head. A glancing blow is never good; the hammer may slip and dent the wood, or the nail may bend. When driving finishing nails, drive them all but flush with the wood.

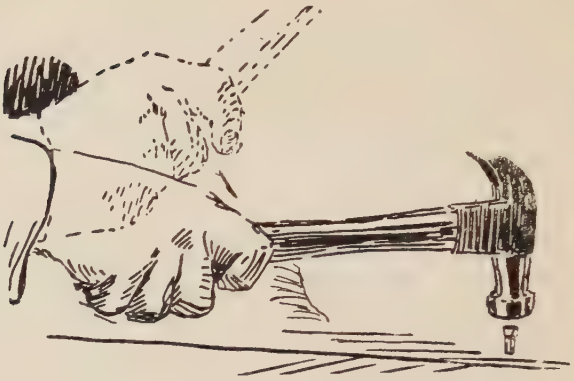


Figure 133

The hammer stroke in driving nail.

Figure 134

Set the nail head below the surface of the wood.

Figure 135

Strike the nail squarely to avoid bending the nail and denting the wood.

In finishing, use a Stanley Nail Set to drive the nail head below the surface of the wood. This is particularly impor-

Figure 136

tant when driving nails in mouldings, in corners or when toenailing.

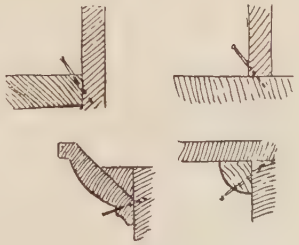


Figure 137

Use the nail set to finish driving nails in corners and on mouldings, etc., where the hammer might disfigure the wood.

A little putty may be used to fill the nail hole after setting the nail below the surface.

There is no secret in pulling a nail. Grasp the hammer handle firmly and tilt it forward with the claws away from

Figure 138

Save the hammer handle and avoid disfiguring the surface of the wood by placing a block under the hammer head when withdrawing nails.

you. Work the hammer claws about the nail with a very slight sidewise movement of the hammer for a secure grip. Then give a firm, steady pull until the nail is withdrawn.

In drawing an extra long nail, place a small block of wood under the head of the hammer. This gives a greater leverage in pulling, and protects the wood from injury.

There is, as a matter of fact, even a trick in using the wiggle nail or corrugated fastener. This little device can be used for tightening up loose joints or cracks in chairs, tables, screen doors, window frames, flower boxes, and other similar things around the house. It is a nail which has a

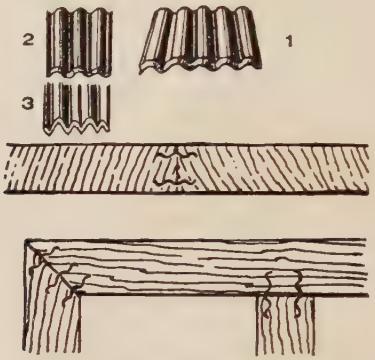


Figure 139

Corrugated fasteners.
1. Divergent corrugations. 2. Plain edge. 3. Saw edge.

good deal of strength for holding two surfaces together side by side.

It should be driven by light blows from a medium-weight hammer. Each blow should be evenly distributed over the top or driving end so that it enters the wood evenly. It must also be driven on a surface which does not vibrate. You may want to put something heavy or solid behind or under the work to brace it.

The wiggle nail is made with plain edges for hard wood and saw edges for the soft woods. Manufacturers of furniture and boxes use enormous quantities. They are

inexpensive and will do a job quickly and easily that would otherwise require expert work.

Every carpenter uses a rasp or woodworker's file and so too does he use a regular file for work on his tools. But filing woodwork is usually not considered good practice. Files are used to enlarge round holes and also to finish curved work that has been sawed near to the line. To the craftsman this is allowable only when the work is exceedingly difficult to reach with a chisel or spokeshave.

Figure 140

In filing, the work should be held on a line about the height of the worker's elbow. The handle should be grasped in the right hand, against the fleshy part of the palm, with the thumb extending on top. The point of the file should be held with the thumb and first two fingers of the left hand, with the thumb on top. A file is made to cut in one direction, therefore the pressure should be on the forward stroke.

The finishing cuts on long, narrow work should be made with the file held at a right angle across the work, and moved back and forth. This is called draw filing.

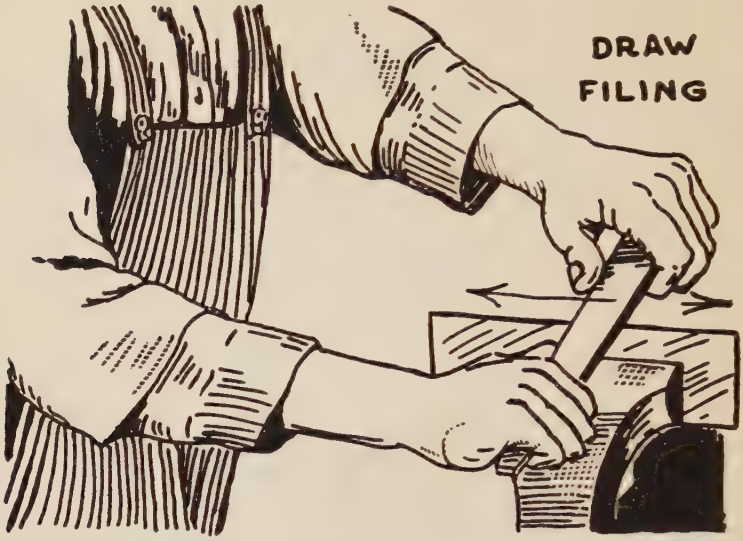


Figure 141

In filing a curve use a sweeping motion diagonally across the grain to avoid making grooves and hollows in the work. This also tends to prevent chipping both edges.

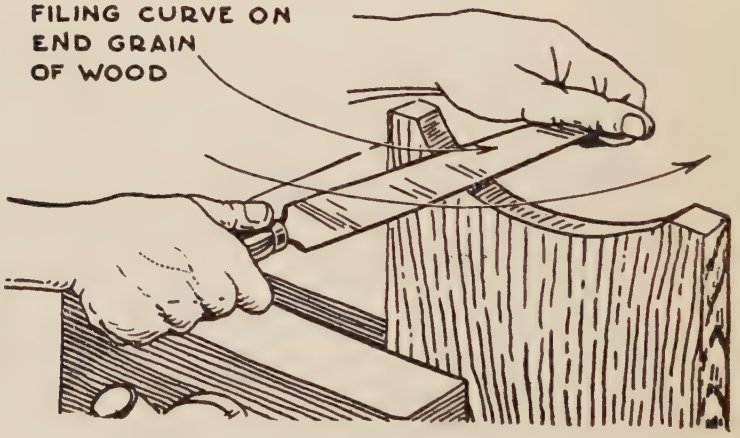


Figure 142

The teeth of a file are delicate and easily broken. Careless handling of files will dull them.

The oil on a new file may be removed by covering it with chalk or charcoal before using.

Files will last much longer if they are cleaned with a file card or brush every time they are used. This does not sharpen the file but will restore its usefulness.

It is well to suit the file to the work in hand.

New files should be used on brass, bronze, or cast iron that need keen cutting. Use holder files on narrow work,

Figure 143

in draw filling, on rough castings, wrought iron, steel and hard metals.

In making things around the house by far the most important thing after you have had some practice and have learned the general principles of chiseling and boring holes and planing is the actual making of the design before you attempt to make the object.

This has already been discussed but before dropping the matter finally let us once more emphasize that fact—more wood is botched, more tempers are tried, by proceeding without a design than by lack of skill.

And the other important thing is the tools themselves and the shape in which you keep them.

It is impossible to economize on tools and produce work which will give you the satisfaction to which the wood-

worker is entitled. It is far better to work with one plane, one saw, one chisel and a few accessories, all of them good, honest steel, properly sharpened, than it is to have a cellar full of inadequate devices. A good hammer and a good free swing will drive a nail home straight and true. A tap with the nail set and the job is done and done to stay. A few strokes with a plane, properly held, and your edge is square, smooth, and true. You have something from which to work. But without that good tool you have nothing. You cannot produce even the simplest bathroom shelf. You cannot put it up so that it will stay and hold a stack of towels or a row of bottles.

Whether you are sawing a thin board that requires no effort or a large piece of timber a good tool is essential. Properly treated, carefully kept sharp, a saw or a chisel, a plane or a brace and bit, will last a lifetime. It will always do good work.

And remember—mark and gauge carefully; use good sharp tools and well seasoned wood; work carefully, little by little, a stick at a time. Respect your design, keep closely to it.

The result of your effort will reward you ten times over.

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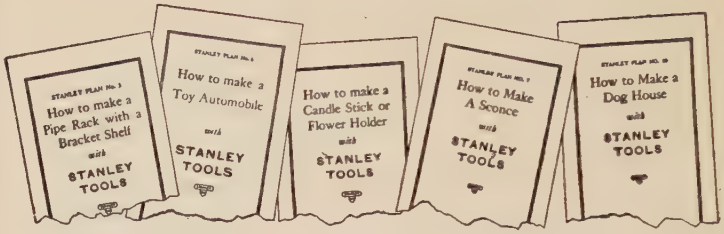

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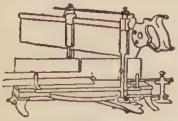

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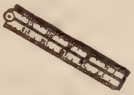

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